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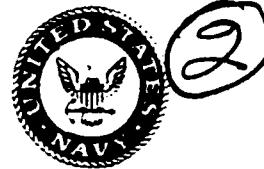
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Total Quality Management
Implementation:
Selected Readings

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TOTAL QUALITY MANAGEMENT IMPLEMENTATION:

SELECTED READINGS

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FOREWORD

Total Quality Management (TQM) is both a philosophy and a set of guiding principles that represent the foundation of a continuously improving organization. By definition, TQM is the application of quantitative methods and human resources to improve (1) the materials and services supplied to an organization, (2) all the significant processes within an organization, and (3) the degree to which the needs of the customers are met, now and in the future.

TQM was first applied in the Department of Defense (DoD) in the early 1980s in a few logistic field activities. In 1987, its use began to rapidly expand with the advent of support from the Office of the Assistant Secretary of Defense for Production and Logistics (OASD (P&L)) (TQM/IPQ). TQM is now one of DoD's primary initiatives.

In 1988, in response to the publication of a Department of Defense statement entitled "DoD Posture on Quality," managers began to ask for information and examples of TQM implementation. To meet that request, OASD (P&L) asked the Organizational Systems Department of the Navy Personnel Research and Development Center to prepare a compilation of readings and case studies to assist managers in implementing TQM. (This present volume serves as a followup to a previous NPRDC publication.) The editors of this present collection surveyed a variety of sources to gather materials, including a review of recent literature and recommendations of TQM theorists and practitioners from both the public and private sectors. All articles included were reviewed to ensure their philosophical support for the DoD "Posture on Quality" and general usefulness to DoD managers. However, this collection should not be considered representative of the total published literature on approaches to quality improvement.

Application of TQM requires that management take on significant leadership roles and responsibilities. Articles in this collection were, therefore, chosen on the basis of how well they prepare managers to take on these new challenges, including how to apply TQM in white collar, administrative, and service organizations. The editors also assumed that most readers already have some basic understanding of the concepts and philosophy of TQM, obtained either by attendance in seminars or workshops on quality or by extensive reading.

For ease of presentation, the various articles have been organized into four sections: Management and Leadership Focus (Section 1), Guidelines for the Development of TQM (Section 2), Quality Improvement Strategy (Section 3), and Case Studies: Special Applications of TQM (Section 4).

The first article in Section 1 provides an orientation on the status of government-wide efforts to improve productivity. It describes the work of a number of federal agencies and identifies major challenges for them in the initiation of comprehensive quality improvement. The other two articles discuss the new roles the quality professional will have in this transformation process. They describe critical organizational changes as well as address general implementation issues.

The articles in Section 2 discuss the critical elements and common components needed to initiate a TQM effort. Edmund Metz (1984) provides a broad-based academic view of organizational change, while the other authors address more of the specific elements needed to implement quality management. All authors agree that there are certain common elements required for this transformation, including top management commitment, the focus on continuous improvement and process analysis, use of extensive measurement, a customer orientation, long-term commitment and planning, and involvement of all members of the organization. These authors also discuss some of the pitfalls, such as the differences between a

quality orientation and previous productivity improvement programs, and reasons why previous approaches have not produced desired outcomes.

The articles in Section 3 address more specifically the critical elements identified in Section 2. These focus on some of the requirements for education and training, the importance of forming teams as the basis for improvement, and an approach to integrating the procedures for process improvement with an organization of cross-functional teams. Also included is an article by Myron Tribus (1988) which discusses the application of some of these critical elements in industrial settings.

Section 4 includes case studies from the public sector, including DoD, the Internal Revenue Service, and the Equal Employment Opportunity Commission. The approaches discussed in these case studies are all different and should not be considered representative of all ongoing military and government efforts. They were selected to provide managers with a broad-based view of how public sector organizations have applied the general philosophy and methods.

Although the underlying philosophy of quality management should be consistent throughout DoD, there is no cookbook approach to organizational change. Implementation should be tailored to each organization. The articles presented here should provide TQM implementers with some guidelines on beginning that task.

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SECTION 1:

MANAGEMENT AND LEADERSHIP FOCUS

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1-3   Joiner, B. L., & Scholtes, P. R. (October 1986).   The Quality Manager's New Job. *Quality Progress, 19*(10), 52-56.

1-1

The Federal Productivity Improvement Effort: Current Status and Future Agenda

Carolyn Burstein and Kathleen Sedlak

The Federal Productivity Improvement Effort: Current Status and Future Agenda

Efforts of federal agencies to improve the quality, timeliness, and efficiency of their services are reviewed.

Carolyn Burstein and Kathleen Sedlak

An earlier article in *National Productivity Review* (Summer 1986), "Meeting the Productivity Challenge in the Federal Government," described the new governmentwide effort to improve productivity. At this writing it is two years since the signing of a presidential Executive Order in February 1986 that aimed at making agencies in the executive branch significantly more productive by 1992. Is that effort still a priority? Are federal agencies making the changes envisioned in the program's goals? What short-term results have been achieved? What is the long-term prognosis for productivity improvement at the federal level? This article will attempt to answer these questions by assessing progress on a number of qualitative and quantitative indicators and explaining changes that are occurring both in program direction and in agency implementation.

It was instructive to reread the earlier *NPR* article to remind ourselves how far we had traveled since early 1986. The program's original design emphasized the need to implement strong agencywide productivity management practices to support future improvement efforts. This has remained the basic thrust of federal efforts, but the original elements that were selected as the essential features of productivity management have been modified to include a much greater emphasis on quality management. This stress on quality reflects a significant change made by the Office of Management and Budget, which directs the governmentwide effort, and the participating agencies. Our odyssey over the past two years in transforming productivity improvement into quality productivity improvement mirrors that of the many other practitioners who have come to realize the close productivity-quality nexus. Encounters with corporate officials in some of the best-managed American companies as well as a continuing perusal of the ever-growing management literature

supported this push in the quality direction. Quality and productivity have now been given parity in federal improvement efforts.

The program's design and operation in 1986 and 1987

The federal program is designed to promote the timely delivery of high-quality, error-free, cost-effective products and services to the American public, using delivery systems that are responsive to customer needs and make the most effective use of taxpayer dollars. To achieve this overall goal, federal agencies are encouraged to: (1) implement total quality and productivity management practices, and (2) make incremental improvements each year in the quality, timeliness, and efficiency of their products and services.

Total quality management (TQM)

Building an infrastructure of total quality management in every agency is considered to be of paramount importance if changes are to have lasting effect; therefore, this has been a principal effort of agency officials over the past year. Figure 1 lists the attributes selected to define TQM.

Any company that has embarked on an effort to implement total quality/productivity management practices knows it is a long-term journey involving not only the implementation of specific management changes, but also a fundamental cultural change within the organization. Given this long-term focus, progress in achieving TQM in government agencies is just beginning. One or two agencies are clearly in the forefront due primarily to extraordinary management leadership; a few agencies have taken the first steps in implementing a number of important TQM features, but the majority of agencies have yet to "catch the spirit" of TQM. Progress among the nineteen agencies participating in the productivity improvement ef-

Figure 1
Attributes of Total Quality Management

- Top management is vigorously committed to quality productivity and this is evidenced in practical management actions.

- A customer orientation permeates the agency, the needs and requirements of both internal and external customers are sought, and the level of satisfaction with the service becomes the basis of improvement efforts.

- Teamwork at all levels is seen as key to improving processes and services

- Quality management and improvement training are provided at all levels of the agency

- Accountability for quality and productivity improvement is tied to managers' performance evaluations

- Recognition and incentive programs are established throughout the agency, are targeted at service improvement efforts, and are used creatively

- Productivity and quality measures are established and high standards are set for quality service delivery in all programs (errors and inefficiencies are not tolerated.)

- Barriers to productivity and quality improvement are eliminated or reduced.

- Agency personnel are constantly stimulated to improve quality and productivity (communication workshops, newsletters, bulletin boards, contests).

fort in TQM implementation is illustrated in Table 1.

The OMB's determination of an agency rating is admittedly subjective, but is based on data accumulated through such sources as on-site monitoring, extensive informal contacts, and quarterly self-reporting by agencies describing specific actions they have taken to implement TQM.

Some top performers in TQM (although all would acknowledge that they are in the earliest stages) are the Internal Revenue Service (IRS), the Naval Air Logistics Center (in the U.S. Navy) and the Forest Service (in the Department of Agriculture).

The IRS has established a Quality Council of top executives reporting to the Commissioner

Table 1
Implementation of Total Quality Management Practices

TQM Implementation	Department Involvement		
	Extensive	Some	Little
Top management commitment to quality/productivity shown in day-to-day management actions	6	7	6
Customer orientation permeates agency	0	7	12
Teamwork and ... seen as key to improving service delivery	1	9	9
Quality management training provided at all levels	.	7	..
Accountability for quality and productivity improvement tied to performance evaluation	0	7	12
Recognition and incentive programs established and used creatively	2	9	8
Measures and standards set for quality/service delivery	.	.0	9
Efforts underway to eliminate barriers to productivity and quality	2	5	12
Constant stimulation to improve quality and productivity	5	8	6

that provides direction for the overall quality program. Quality councils also operate at the ten service centers. The Commissioner has published five guiding principles for the agency: (1) quality is first among equals with schedule and cost; (2) systemic flaws that interfere with product and service quality are to be eliminated; (3) responsiveness to the public is to be improved; (4) a quality improvement process will be installed in every major part of the IRS; and (5) quality will be emphasized in the evaluation of systems. Over 10,000 senior managers have been trained in quality management, and quality improvement teams are operating on a broad scale throughout the agency.

Already the focus on quality has produced results: improvements ranging from innovative "one-stop taxpayer services" (eliminating referrals of customers to multiple sources) to electronically processed tax returns have resulted in significant gains. For example, of the 1.2 million Federal Tax Deposit accounts received each week in 1986, from 30,000 to 40,000 kicked out of the system due to processing errors; in 1987 error rates were down to from 3,000 to 4,000 per week on a volume of about 1.5 million.

At the Naval Air Logistics Center, total quality management is the underlying theme of ambitious plans for continuous improvement at all six naval aviation depots. These depots provide worldwide maintenance, engineering, and logistics support to the fleet. Total quality management efforts started with an awareness phase, where 200 top managers were provided valuable education and tools for embarking on the program. The Navy has implemented strategies encompassing all aspects of quality management, including a focus on customer requirements, extensive employee training in the use of statistical process control, long-term business planning, employee rewards through gainsharing, the introduction of new automated processes, and use of corrective action teams. Quality and productivity improvements have resulted in better maintenance of F-14 planes and an ability to meet tight production requirements in the Mobile Maintenance Program. The depots are forecasting savings of over $1 billion by 1991 through the reduction of quality failures.

The Forest Service has recently completed an experiment in several national forests in which top management loosened up the constraints of bureaucratic red tape on employee creativity and

entrepreneurship. Authority was delegated to the lowest possible level. and employees were encouraged to take risks and be innovative in responding to customer needs. During the experiment. National Forest staff operated in an environment in which only the ordering of priorities was defined and the budget was provided in lump sum (rather than by line items), maximum flexibility was given to get the job done. personnel ceilings were lifted. all savings could be retained for high priority work. and experimentation and a bottom-up approach to change were encouraged—no one could "fail." The Forest Service had one ground rule: "If it is legal and within basic policy bounds. go for it."

Results were dramatic. Substantial paperwork was eliminated. morale and organizational spirit soared. Unit costs in the experimental forests were reduced 15 percent: of a savings pool of $175.000 in one National Forest. 20 percent was distributed to the employees and the remainder was used to improve service to customers: district rangers began processing all public permits in a few hours rather than a few weeks as a result of simplified paperwork: 109 employee suggestions for better ways of doing business were implemented in one of the experimental forests. In 1988. the Forest Service is expanding the program to all forests in the 20 states in the Northeastern United States and anticipates expansion to the entire country as the agency trains its managers and employees in quality management.

In all three agencies. the dedication to quality of the top executives has provided the vision and leadership essential to forming a TQM culture.

Improving quality, timeliness, and efficiency of services

As TQM practices are implemented in the agencies. the payoff in service improvement is expected to follow. In early 1987, agency officials developed a complete inventory of program services where they plan to initiate productivity and quality improvement between 1987 and 1992. Al-

most 700 programs have been listed. employing nearly two million federal workers. (The Postal Service is not included in the inventory.) The number of programs by agency and employment levels in the program services are listed in Table 2.

The programs in the inventory have been grouped into a number of categories, which illustrate the variety of government services to be targeted for improvement:

- Claims/applications:
- Communications:

Table 2
Agency Productivity Program Inventories

Agency	Functions in Inventory	Employees in Inventory
Agriculture	64	67 000
Commerce	28	20 000
Defense	150	1 300 000
Education	12	3 200
Energy	9	6 500
Environmental Protection Agency	25	5 000
Fed Energy Reg Commission	54	750
General Services Admin	18	14 000
Health & Human Services	45	80 000
Housing & Urban Development	30	8 500
Interior	53	37 400
Justice	31	51 000
Labor	49	15 700
Nat Aeronautic & Space Admin.	6	3 800
Office of Personnel Management	14	2 800
State	9	3 000
Transportation	22	73 000
Treasury	30	105 000
U.S Information Agency	9	4 500
Veterans Administration	12	190 000
TOTAL	680	1.991 450

In 1987, the first full year of the productivity program, thirty-six program services were selected by the agencies for improvement.

- Distribution services:
- Education and training:
- Financial services:
- Health services:
- Information services:
- Investigation enforcement:
- Licensing certification:
- Loans grants:
- Maintenance:
- Natural resources management:
- Social services and benefits:
- Specialized production:
- Support services and operations:
- Testing inspection: and
- Transportation traffic management.

In 1987. the first full year of the productivity program. thirty-six program services were selected by the agencies for improvement. The quality. timeliness. and efficiency of these services were tracked during the course of the year and will continue to be monitored from a 1985 baseline level. In 1988. sixty-five more program services will be added by the agencies to the original thirty-six. and ninety-nine more will be added in 1989. By 1989. then. 200 services will be targeted for improvement. employing about 725,000 workers. The growth of program participation in terms of number of services and employees is displayed in Figure 2.

Of the thirty-six services targeted for improvement in 1987. thirty have been reported by the agencies as of the time of writing for this article. Table 3 highlights efficiency improvements.

Of the thirty programs reporting data. fifteen program services reduced their unit costs. while fifteen programs experienced an increase in unit costs. The overall average change in unit costs of the thirty programs reporting data is a 1.7 percent reduction. It should be noted that many of the short-term cost increases are due to initial investments in equipment and or people that are anticipated ultimately to pay off in more efficient operations.

For example. significant computer modernization efforts underway in Census Publication. the Federal Aviation Administration's Flight Service Stations. and the Veterans Administration's Insurance Program. and across most of the Federal Energy Regulatory Commission's programs. require short-term investments that have boosted unit costs. In a few programs where unit costs rose significantly (e.g.. Housing and Urban Development's Single Family Applications Processing and the U.S. Coast Guard's Ship Review). there was major turbulence in 1987 due to new policy directions and the ripple effects of the Gramm-Rudman-Hollings budgetary cuts. which caused some displacement of personnel and concomitant program problems. In the program over-

Figure 2
**Federal Program Participation by Services and Employees**

1989—99
1988—65
1987—36
1990-1992—480

680 Total Services

1989—230,000
1988—395,000
1987—100,000
1990-1992—1,267,000

1.9 Million Employees
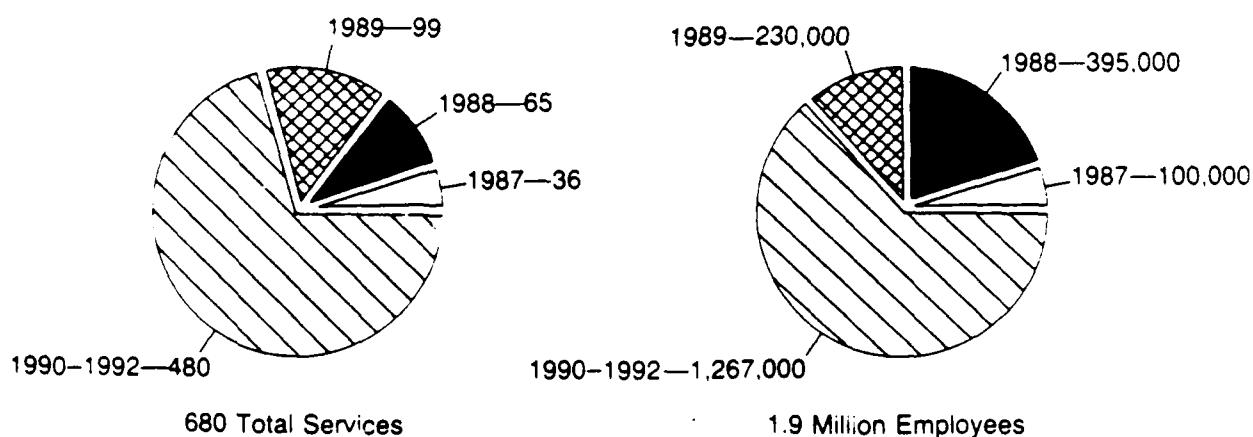
Table 3
Efficiency Improvements in 30 Program Services

Agency	Program Function	Unit Average Cost in $*			Percent Change in Cost from 1986 to 1987
		1985	1986	1987	
Agriculture	Quarantine Inspection	(data not available)			
Agriculture	Meat Poultry Inspection	0.0017	0.0016	0.0015	-4
Commerce	Census Publication	17.72	14.24	15.86	..
Commerce	Census Data Collection	12.58	12.21	11.85	-3
Defense	USAF Vehicle Maintenance	(data not available)			
Defense	USN Aircraft Maintenance	91.95	90.68	89.54	-1
Education	Student Aid Audits	189.43	128.34	109.49	-15
Education	Elig Cert Higher Ed	172.50	188.99	194.85	3
Energy	State Local Energy Asstnce	data not available			
Energy	Weapons Quality Assurance	148.06	178.66	184.55	3
Env Protection	Grants Administration	652.40	652.27	652.93	2
Fed Energy Reg	Wellhead Refunds	109.48	124.15	87.85	-29
Fed Energy Reg	Minor New Capacity	17.685.17	17.666.56	22.924.04	30
Fed Energy Reg	Small Power Production	1.666.67	1.098.85	2.060.00	87
Fed Energy Reg	Major New Capacity	34.008.62	28.190.95	36.855.24	31
Gen Svces Adm	Commodity Management	(data not available)			
Gen Svces Adm	Retail Supply		3.33	2.72	-18
HH Human Svcs	Retiremnt Disability Ins	192.36	185.61	175.50	-6
HH Human Svcs	SS Redeterminations	(data not available)			
Housg Urban Dev	Title I Loans	0.66	0.50	0.31	-39
Housg Urban Dev	Single Family App Proc	63.42	36.41	53.45	47
Interior	USGS Map Distribution	0.45	0.43	0.40	-6
Interior	Mineral Royalty Payments	11.21	12.78	13.05	2
Justice	Alien Applications (INS)	19.73	17.66	18.18	2
Justice	Prisoner Transportation	179.89	146.95	149.82	2
Labor	MSHA Mine Inspections	(data not available)			
Off Persn Mgt	Background Investigatns	398.95	473.89	369.28	-7
State	Passport Services	7.24	7.45	5.65	-24
Transportation	Flight Assistance	3.67	3.67	4.11	12
Transportation	Engineering Graphics	15.52	16.68	16.60	-2
Transportation	Aviation Standards	64.18	59.28	61.22	3
Transportation	USCG Ship Review	119.38	104.00	147.25	42
Treasury	Customs Cargo Exam	39.43	37.52	35.08	-7
Treasury	Tax Forms Distrib	2.52	2.22	1.55	-30
Veterans Admin	Insurance	58.70	53.80	57.48	7
Veterans Admin	Warehouse Distrib	5.63	5.33	4.56	-14

*Costs are deflated and shown in 1985 constant dollars

all. a 1.7 percent cost reduction is a creditable performance in programs that are largely service-related rather than production-oriented.

Efficiency improvements are determined by measuring final outputs or services to the public and their associated costs. The cost of all internal tasks and activities required to produce the final output are included: labor, capital facilities and equipment, purchases and contracts, and other items such as travel, utilities, and training. Where final outputs are a single type of service or product, such as the issuance of a retirement insurance check, *unit costs* are calculated. Where the final outputs of a program result in multiple services being delivered, such as various types of compliance inspections performed. the outputs are

> *What is clear from an analysis of the improvement methods that agencies employed is that no single best solution predominates.*

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weighted and aggregated. In such cases. *average costs* are calculated.

Of the thirty services reported by the agencies. twenty-seven made quality and timeliness improvements or met their established standards. Quality and timeliness measures and standards are specified by agency program managers, who describe and explain them in their annual plans and report on changes in quality and timeliness levels in their end-of-year reports. Since quality and timeliness measures vary in number and by function and are not susceptible to succinct display. the following examples have been selected to illustrate the types of improvements that occurred in 1987:

- In Commerce. one measure of quality improvement in Census Publications is the level of phototypeset materials included in publications. By year-end 1987. Census materials contained 21 percent more phototypset materials than in 1985.

- The Geological Survey in Interior took 10 working days to process new orders for maps in 1987 compared to 20 working days in 1986. Quality standards remained constant: accurate input of 155 or more publication items per hour per employee into a computer system. In 1988. additional customer service concepts will be introduced. such as an "800" telephone number for orders. use of credit cards for payment. regional distributorships. and discount procedures.

- By reducing front-end rejection rates in processing royalty payments, the Mineral Management Service in Interior reduced its accrued interest liability to states to $253,000 in 1987. This compares to a 1986 liability of $300,000 and a 1985 liability of $1.1 million. most of which was due to processing errors that delayed disbursement of proceeds to the states, thus incurring interest penalties. The percentage of timely disbursements to states was over 94.7 percent, which approached the 1987 goal of 97 percent. Timeliness will be the focus of improvement in 1988.

- The U.S. Coast Guard in Transportation continued its high quality performance in reviewing commercial vessel plans. Of 16,065 reviews

completed in 1987, only 12 complaints were received requiring a change to final action, less than 0.1 percent of the total volume reviewed. This was roughly the same low complaint rate as in 1986. Efficiency, which was considerably lower in 1987 than in 1986, will be the focus of improvement efforts in 1988.

- The Department of Education. by applying automated data processing capabilities and advances in word-processing technology. reduced total processing time for determining the eligibility and certification of institutions of higher education by 20 percent compared to 1986.

- The average time to process a loan for property improvement and purchase of manufactured housing in the Department of Housing and Urban Development was eighty-six days in 1985. twenty-nine days in 1986. and only twenty-two days in 1987.

- The Veterans Life Insurance Program completed all insurance-related transactions (e.g.. loans. payments of claims) within timeliness standards 90.2 percent of the time in 1987. a marked improvement over the 1986 level of 76.8 percent.

- The processing of disability insurance claims in the Social Security Administration in the Department of Health and Human Services was reduced to 73.9 days in 1987 from 81 days in 1986.

The efficiency. quality. and timeliness improvements illustrated above have been accomplished through the implementation of a variety of improvement strategies that fit the specific circumstances, environments, culture, and problems of each program service. What is clear from an analysis of the improvement methods that agencies employed is that no single best solution predominates. Improvement strategies include: automation of labor-intensive operations; simplification of work procedures and methods; the use of more advanced coordination with other organizational units; consolidation of field units; participative management; and employee training. career development, motivation, and incentive programs. Often, many of these improvement strategies are used in combination.

Other significant accomplishments in 1987

In addition to their efforts to upgrade the program services targeted for improvement in 1987, agencies also prepared productivity improvement plans for 1988 and 1989 on another 164 services. (See Figure 2.) This involved developing measures of output, quality, and timeliness for the first time for many of these program services. For others a major effort to improve existing measurement systems was undertaken. A baseline is required for each service so that progress attained can be measured and compared from a starting point. All this has required a considerable commitment of time and effort. Over the past two years, the Bureau of Labor Statistics has provided technical assistance in measurement for agencies and helped managers to develop useful, straightforward, and easy-to-understand measures for their programs.

In their 1987 annual accomplishments reports, many agencies also noted that significant progress was achieved in services not yet *formally* included in the governmentwide focus on productivity and quality. Here are some examples:

● The National Aeronautics and Space Administration's (NASA) contractors are crucial to the space program, since over 75 percent of the agency's budget goes to the private sector. To promote productivity and quality enhancements, NASA has set up an annual award that focuses attention on exceptionally high standards of performance by NASA contractors. In October 1987, the award winners were announced for the preceding year: Martin Marietta's Manned Space Systems and IBM's Federal Systems Division. Martin Marietta builds the external fuel tank for the space shuttle and received the award for cutting manufacturing hours by 53 percent. The company also lowered nonmanufacturing labor support by two-thirds, while improving product quality by cutting manufacturing discrepancies by 76 percent. IBM produces the software for on-board computer systems for the shuttle. The company reduced the number of software errors in these very complex programs to near zero, while lowering by over 50 percent the time and effort required to reconfigure the flight software. The federal government, as a customer, received a high quality product, on time, and at a reduced cost.

● The National Technical Information Service (NTIS) in the Department of Commerce received the 1987 U.S. Senate Productivity Award for Virginia for its innovative use of automation, quality circles, improved communication, professional development, and integrated planning systems to achieve productivity gains. NTIS is the central source for the public sale of government-sponsored research, development, and engineering reports.

● The Federal Aviation Administration inaugurated Phase I of its East Coast Plan in 1987 to improve the use of airspace in the Northeast. Phase I established or modified thirty-six jet routes and thirty-three low altitude airways, increased the number of departure routes from New York by two-thirds, and increased the number of available high altitude North-South jet routes.

● The Department of Transportation's National Driver Registration Program supports state driver licensing agency needs for rapid detection of problem drivers. The program is being redirected to a new and faster concept called the Problem Driver Pointer System. Under the new system, a state considering issuance of a driver's license can inquire through a Register about the applicant's driving record in other states. The Register will serve as an on-line switchboard between the inquiring state and the state that has specific data related to an applicant's record. The effect will be to reduce the time involved in identifying a suspended or revoked driver from days to a few hours—at most overnight. The new system is currently being tested in four states and is expected to be available nationwide in 1989.

● The Department of Housing and Urban Development (HUD) is taking actions to minimize the number of properties it takes into inventory by paying claims to lenders who are able to sell the properties themselves and hiring private firms to handle the disposition of properties. HUD is seeking to dispose of its "aged" inventory of homes

The FBI has improved significantly the efficiency and quality of its examinations through the marrying of forensic science specialists and modern technology.

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through bulk sales of these properties. These actions are expected to reduce the number of months that units remain in inventory from eight to five and increase the share of the claim recovered from the sale of the property from 72 percent to 77 percent.

• The Urban Mass Transit Administration (UMTA) in the Department of Transportation is improving its grants administration activities by delegating grantees more responsibility in local contracting matters and providing more flexible use of staff among regional offices to correspond to shifting workloads. By 1989. UMTA will initiate a new self-certification procedure for grantees. which eliminates UMTA pre-award reviews for most types of contracts. By raising its review thresholds for all pre-award reviews and eliminating protest reviews. UMTA will substantially reduce the number of grantee contracts that it reviews while ensuring at the same time that the quality of the review process remains intact.

• The Federal Bureau of Investigation (FBI) Laboratory Division performs more than 120 different types of forensic science examinations in response to requests from international. federal. state. and local investigative agencies. The FBI has been able to improve significantly the efficiency and quality of its examinations through the marrying of forensic science specialists and modern technology. Benefits are produced not only in better. quicker. more comprehensive federal investigations. but in upgrading state and local forensic capability and in developing new technologies for future improvements. The Division strives to achieve 100 percent accuracy on all examinations performed. To reach this goal. the Division performs a number of quality assurance tests and reviews: utilizes peer review. product testing. and instrument calibration; and carefully selects and trains examiners.

• The Department of the Air Force (AF) will drastically cut paperwork and greatly increase productivity as a result of a recently awarded contract with Xerox Corporation to automate the publishing of all AF printed material including manuals. regulations. forms. and pamphlets. Under the new system. publishing work stations installed at all AF sites will be linked to the central Air Force data base and allow employees around the world to access and update existing forms and manuals instantly by using their own terminals. A revised regulation, for example. could be called up by an officer in West Germany via overseas communications links and then be instantly printed at his or her location.

Future directions

The focus on building a quality culture in government will mark the future direction of agency efforts. This will require not only comprehensive education of the federal work force in Total Quality Management but also the widespread promotion and recognition of achievements by agency managers and employees to improve services and put the customer first. Numerous major activities are underway to help make this push for quality a reality in government.

Quality improvement education

To build a tradition in government of quality consciousness that orients employees to customer needs and commits them to defect-free work processes and continuous improvement requires a change in attitude and mindset achievable only through comprehensive quality improvement education. Education is the key stimulus for changing the way in which managers and employees view their roles. It is the vehicle that enables employees to develop expertise in the best practices of quality management used by the most successful private-sector firms. Achieving significant quality and productivity enhancements will not be easy, nor are short-term expectations high. Substantial gains are expected only after a long-term commitment to continuous improvement of at least five years. The most important step is getting started. which is why plans are underway

to establish a Quality Center to provide first-rate training for all federal managers and employees in quality improvement modeled after winning private-sector efforts. The aim is to stimulate quality awareness, create an environment of total quality management, and provide the tools needed to achieve it in every federal agency.

In October 1987, representatives of several U.S. companies noted for a commitment to quality and a customer orientation— Westinghouse, IBM, 3M, Marriott, First Chicago Bank, Honeywell, Hewlett-Packard, Corning Glass, Florida Power and Light, Xerox, John Hancock Insurance, and Metropolitan Life Insurance—met with federal officials to discuss ways to instill a quality culture within the federal government. Federal executives from OMB, the Office of Personnel Management, the U.S. Coast Guard, the Federal Bureau of Investigation, the Internal Revenue Service, the Forest Service, the Veterans Administration Benefits Program, the Social Security Administration, and the Federal Aviation Administration joined private-sector quality experts in strongly endorsing the concept of a Quality Center to provide quality management education in government.

In November, a Board of Directors was appointed to serve as the key decision-making body for the Quality Center. The Board consists of several potential customers of the Quality Center— agency heads from the Forest Service, Internal Revenue Service, Social Security Administration, Veterans Administration Benefits Program, Office of Personnel Management, Office of Management and Budget, and a representative of the President's Council on Management Improvement. Senior staff from these agencies have reviewed quality improvement training offered in educational institutes or centers (e.g., the American Productivity Center, the Juran Institute, and the Virginia Productivity Center) as well as within numerous companies and organizations. Multiple training approaches to fit the special needs and circumstances of different agencies have been recommended to the Board. As soon as decisions have been made regarding training approaches, implementation will begin. A target date of June 1988 has been set for opening a Quality Center.

Quality improvement prototypes

Simultaneously, another effort is being undertaken to promote quality awareness throughout government. OMB is working with the agencies to identify three or four significant successes in quality and productivity improvement and highlighting them as prototypes. Widespread recognition will be given to the programs selected as prototypes to spur expanded efforts in quality productivity management activities. Other objectives include developing models for other programs, cultivating a sense of pride in government service, providing high visibility and recognition for top achievers, and using the experience of successful models as case studies in the Quality Center.

Initial steps in the selection process have been made. Prototypes or models were selected based on criteria stressing: (1) a strong agency-wide total quality and productivity improvement effort; (2) well-defined strategies for improvement; (3) emphasis on quality, timeliness, and efficiency; and (4) demonstrable improvements. The IRS and Navy stand out as likely candidate agencies, having already demonstrated a strong commitment to quality improvement as a result of top management backing. Specifically, the IRS' Federal Tax Deposit System and One-Stop Taxpayer Service (a pilot now operating in northern California) and the Naval Aviation depots in Cherry Point, North Carolina, will be highlighted.
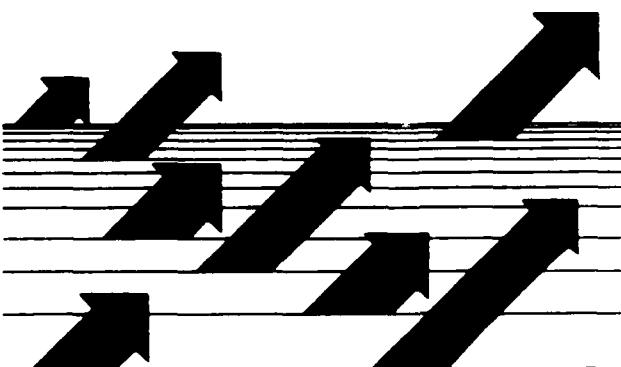
*Federal Service Centers offering multiagency
and multiprogram services will be the initial
point of contact with the public.*

The effort to identify management activities will be an ongoing process, with the development of three or four prototypes each year. Information on the prototypes will be disseminated broadly to other agencies and the general public. Recognition will include widespread publicity and awards conferred at special forums.

Improving employee incentives and recognition programs

Full employee participation is an integral facet of the total quality productivity management process. To support this involvement, agencies are striving to go beyond traditional awards (cash awards, special plaques) and use greater creativity in recognizing employee efforts to achieve meaningful results.

As a result, some agencies have implemented gainsharing on an organizationwide basis. For the past several years, the Department of Defense and the IRS have become leaders in the gainsharing area by establishing several gainsharing programs that shared productivity gains with employees. The Social Security Administration is currently implementing an agencywide gainsharing program, but most agencies have not explored this highly motivating option. The Office of Personnel Management, which oversees employee monetary incentive programs, has endorsed gainsharing, publicized information about it, and assured agencies that they have authority to initiate such programs.

During 1987, the Office of Management and Budget proposed a governmentwide gainsharing program know as "Shared Savings." It was developed as a three-year experiment to provide incentives to all agencies and their employees to improve the productivity and quality of their services to the public. Under this approach, 50 percent of the savings generated by productivity improvements would be retained by the agency and 50 percent would be used for budget deficit reduction. Agencies would have discretion to use some of their savings for productivity-enhancing investments as well as employee bonuses. The Shared Savings concept received early congressional backing but floundered during final enactment of the fiscal year 1988 appropriations bill in December 1987. OMB has not yet made a decision about whether to pursue gainsharing as a governmentwide initiative in the 1988 congressional session. Individual agencies will be encouraged, however, to initiate their own gainsharing programs.

At the present time, a Presidential Award is planned for 1988, and several agencies are inaugurating special productivity and quality awards to be delivered by the department or agency head. Much more needs to be done by all agencies to motivate and recognize employees on a continuing basis throughout the year.

Impact of the improvement effort in the long-term future

As more and more federal employees adopt the precepts of TQM, it is expected that significant changes will be made in operating philosophies and systems affecting the federal government's structure and service delivery. Commitment to quality and productivity—meeting consumer requirements and offering error-free services for the best price—have tremendous potential for dramatically changing government services as we know them.

We envision that by the year 2000, Federal Service Centers offering multiagency and multiprogram services will be the initial point of contact with the public. Such centers would function as information clearinghouses and offer processing and referral services. Fixed and mobile offices would operate at times and locations convenient to the public. Electronic linkage of these centers and offices to central data bases would provide added convenience to customers. For example, responses to questions about benefit determinations and eligibility and payment changes could all be made in a day.

Conclusion

Quality and productivity improvement efforts currently underway pose major challenges to agencies: comprehensive quality improvement education is just beginning: top management support is uneven: a customer orientation is frequently lacking: measurement systems are not widely understood or implemented; needed investments for long-term gains are scarce. Nonetheless. the federal government has begun the journey toward achieving a quality management culture. If high-quality. error-free products and services are delivered courteously. in a timely manner. and at the best price. the payoff will be substantial in terms of better satisfied customers and employees who take increasing pride in their work.

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1-2

The Quality Professional's Role in the New Economic Age

Edward M. Baker

The Quality Professional's Role in the New Economic Age

The quality profession can play a vital part in a company's efforts to maintain stability while transforming itself

by
Edward M. Baker

ORTH AMERICAN BUSINESS is going through a period of explosive. accelerating change in its competitive external environment. This is increasing the pressure on firms to change internal systems to more competitive ways of operating. Each year, the number of technological innovations seems to double while the time for that technology to find its way into the market in the form of goods and services is shrinking—almost halving. Instant electronic communication. rapid global travel, and other forms of immediate gratification of needs are continually changing consumer expectations. habits, and behavior patterns. Consumers are on the lookout for products and services that gratify needs that they can't yet imagine.

D.A. Schon has called the phenomenon of rapid change the "loss of the stable state."[1] He has observed that most of the technological knowledge existing at any time within the past few hundred years has been discovered within the memory of those alive. As the time to diffuse technology to the consumer has shrunk—from generations to a fraction of a generation—problems of adaptation have increased. Alvin Toffler has noted the "generalized speedup of the corporate metabolism" and observes that many business people and executives see the certain world they once knew "tearing apart under the impact of an accelerating wave of change."[2] W. Edwards Deming has provided management with a new set of principles for operating in the "new economic age."[3]

The enterprise of the 1990s has to develop the capability to simultaneously:

• maintain consistent, repeatable production processes—to prevent change.

• continually transform its processes, systems, and structures to take competitive advantage of ever-diminishing periods of environment stability.

Nature teaches us that organisms that are highly specialized for a specific purpose and a given environment become extinct when the environment changes and they do not. In the new economic age, the successful enterprise will develop a capability for stable self transformation—to manage its own change without throwing itself into a state of chaos.

To accomplish this difficult goal, management must create the environment for intelligent and cooperative interaction between the many internal functions of the enterprise. At the same time, management must involve all members of the organization in the transformation and improvement of the systems and processes in which they work. People's expectations about work, their role, and the rewards provided by the enterprise also have changed dramatically over the decades. A large gap exists between people's potential ability and their actual commitment to perform.[4] Yet commitment must be high if people are to contribute fully their knowledge, skills, intellect, and creativity to help the enterprise improve. Management's leadership can provide the vision to unify the enterprise, create commitment, and transform that commitment to action.

Technical foul for quality interference

Competitive viability is synonymous with total organizational quality, the capability to continually assess and translate customer requirements into the requirements of the organization's processes. In order for these processes to produce real value (in terms of product/service features, performance, and price) for customers, they must be freed from waste and resources whose sole function is to cope with expected process breakdowns. Each part of the process should add something the customer values rather than remove something the customer does not want. Total quality lowers the cost of doing business.

The natural flow of processes is horizontal—lateral—but the paths, channels, and pipelines are vertical. Most of today's enterprises are still structured according to mechanistic principles of operation (left side of the scale in Table 1) established at the beginning of the twentieth century under very different economic,

Table 1.
The Future Role of the Quality Professional:
Helping the Enterprise Make the Transformation

From *Thinking, Believing, Acting as if:*	*To* *Thinking, Believing, Acting as if:*
• The enterprise operates in a static, unchanging environment.	• Explosive external change is inevitable and provides opportunities for those able to create competitive advantage from change.
• Internal stability and good control are defined by absence of negative deviations to plans and objectives. If these occur, find (and blame) the individual responsible. If there is time, fix the problem.	• Stability and control are statistically defined by the natural variation of the process. Improvement comes from working on the system of common, mutually interacting causes if the pattern of variation indicates stability; otherwise, leave it to the discretion of local "process managers" to identify and remove "special causes" if they can. If not, provide help.
• Managing means maintaining a stable internal state. Mechanistic management principles and rigid structures are needed for control and avoidance of change	• Managing means maintaining a balance between prevention of change and creation of positive change. Management structures enable learning and self-organization in order to anticipate and meet changing environments and new situations. "Scientific methods" of research with statistical and other tools enable people to study and improve their processes.
• Control is achieved by pre-established, inflexible response patterns given in the "book" of rules and procedures. People are customers of the "book," which prescribes appropriate behaviors.	• Control is achieved by enterprise shared values and beliefs, knowledge of mission, purpose, and customer requirements.
• Customers are outside of the enterprise and are within the domain of marketing and sales.	• Everyone inside the enterprise is a customer of an internal or external supplier. Marketing concepts and tools can be used to assess internal customer needs and communicate internal supplier capabilities.
• The functional provinces are in a zero sum game where there must be a loser for every winner. People cannot be expected to cooperate unless it serves their own or their unit's best interests. Parochialism is a fact of business life.	• Self-interest and the greater good are served simultaneously by serving one's customers. Everyone wins or no one wins.
• The enterprise is a collection of separate highly specialized individuals and units linked within the functional hierarchy. Lateral connections are made by intermediaries close to the top of the provinces.	• The enterprise is a system of interdependent processes linked laterally through a network of collaborating suppliers and customers. The processing systems are connected to the enterprise's mission and purpose through a vertical hierarchy of micro to macro processes.
• The manager's job is to do the subordinates' planning, and inspect the work to make sure plans are followed.	• The manager's job is to manage his or her own process and its interfaces and give subordinates the capability to do the same. Managers provide leadership rather than over-intervention in the processes of their subordinates, who are viewed as process managers.
• People are passive contributors, with little autonomy, doing what they are told and nothing more.	• People are active contributors, valued for their creativity and intelligence.

Figure 1. Process Quality Possibilities in a Functional Hierarchy

Company "B"
Traditional Vertical
Structure
(Highly Simplified)

Predominant
direction of
information flow

Data
Entry
Operator

Accounts
Payable
Clerk

Traffic
Analyst

Company A

Company B

Company A

Accounts Receivable	Invoice Payment Process			Accounts Receivable
	Traffic	Data Entry	Accounts Payable	

Invoices Documents Payment Data Check
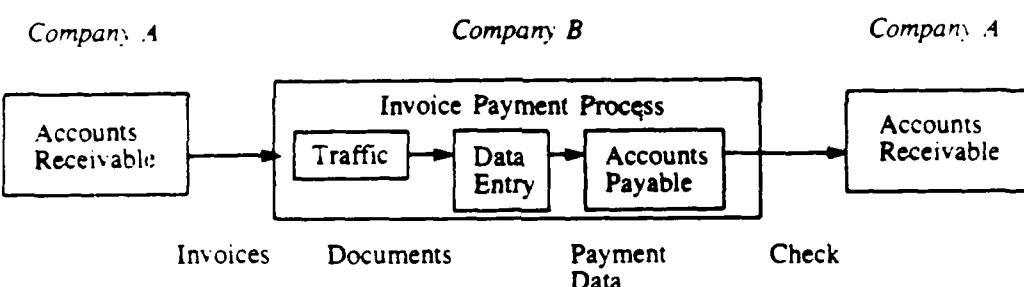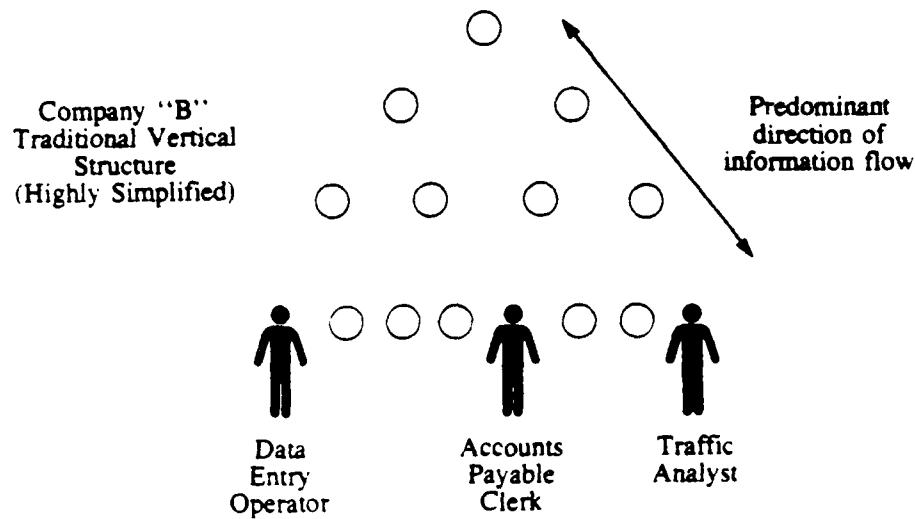
| Possible Process Flows	Quality at the Process Interfaces ○ = ok (on time, no errors, complete, etc.) ● = not ok (late, errors, incomplete, etc.)			Quality Delivered to Final Customer
1.	○	○	○	○
2.	●	○	○	●
3.	○	●	○	●
4.	○	○	●	●
5.	●	●	○	●
6.	○	●	●	●
7.	●	○	●	●
8.	●	●	●	●

Figure 2. Complexity in the functional hierarchy inhibits process quality

Traditional Structure (Highly Simplified)	Level in Hierarchy	Number of Cousins (People at the Same Level) When Span of Control = 2	Potential Lateral Interfaces
	0	$2^0 = 1$	$\frac{1}{2}(1 \times 0) = 0$
	1	$2^1 = 2$	$\frac{1}{2}(2 \times 1) = 1$
	2	$2^2 = 4$	$\frac{1}{2}(4 \times 3) = 6$
	3	$2^3 = 8$	$\frac{1}{2}(8 \times 7) = 28$
		15 people	35 lateral

Total number of interfaces = $\frac{1}{2}(15 \times 14) = 105$
(lateral + vertical + diagonal)

NOTE: n is the number of people. Number of interfaces = $\frac{1}{2}[n(n-1)]$

technological. and social conditions. The vertically structured, functionally oriented organization was designed and operated to cope with the needs of machines. not people. Machines had to be maintained to protect the company's capital investment. The system behaved as if people were expendable commodities along with other inputs to the machines. These structures fragment the processes of the enterprise and inhibit quality. They are not attuned to dealing with the needs of people.

Functionally oriented. vertical management structures present obstacles to quality—even when everyone has the best intentions, commitment. desire. and philosophy. The complexity in most enterprises offers too many opportunities for the process to fail. Figure 1 shows how quality is likely to be degraded as a product or service moves through a functionally organized hierarchy. In this example. the process—the payment of supplier invoices— appears to be simple. Company A bills Company B for products and services it has provided and in turn becomes the customer of Company B's invoice payment process. This process involves three of the eight specialists at the bottom of the organizational pyramid. It is likely that these individuals in these functions do not view themselves as part of a broader process or perceive their work as serving a customer. Let's say that Company A's quality requirements for payment are that the check be:

- paid on time.
- completed without errors in amount or other information.
- accompanied by accurate and complete documentation.

It is useful to look at the process as a network of supplier-customer interfaces, with each processing system playing first the role of customer/user of inputs and then of supplier/producer of outputs Figure 1 shows eight ways for the process to operate. Failure to meet final customer requirements can be caused by failure to meet internal customer requirements at any stage of the process. Any failure along the way adds cost in the form of time for redo, compensation for delays (e.g., premium mail), transmis-

sion and possible amplification of errors, customer inquiries that must be answered or returns that must be reworked, and internal customer requests for proper information to complete the transaction. The additional waste of inspection and checking (usually by the supervisor) that characterize poor quality processes is not shown—nor is the employe demoralization that accompanies such activities.

Of the eight possible ways for this process to operate. only the first meets the requirements of accounts receivable. If each of the eight combinations is equally likely. the final customer will be satisfied only one time in eight while being subject to errors. delays, or incomplete information seven times in eight Like most processes, this one—if left to chance—will deliver poor quality more often than not. Thus, the ability of each stage to meet the requirements of the next customer must be assured. This implies that each supplier/producer identify customers. define their requirements, and determine what is needed to meet them. Assuring the interface is difficult in the vertically structured enterprise

Figure 2 shows the difficulty of direct, unobstructed communication between internal customers and suppliers in the functional hierarchy. The organization is highly simplified, depicting only three levels below the top executive and a span of control of two. Thirty-five lateral interfaces are possible. The 28 possible interfaces between technical specialists at the bottom of the organization is four times the number of interfaces possible at the supervisory and management levels. Yet, traditional vertically oriented structures add complexity by requiring even more intermediaries, the bosses, adding time and people to the process Often, the people at the bottom of the hierarchy do not know with whom—or if they do know, they just don't have the autonomy— to communicate directly. When you add in the vertical and diagonal interfaces, there are 105 possible two-person relationships. Some of these represent what should be explicit supplier-customer interfaces.

Figure 3. Proliferation of Complexity with Vertical Height (Number of Levels)
(Shown: Six-Level Hierarchy with Span of Control = 3)

Level	Number of Cousins = 3^{Level}
0	$3^0 = 1$
1	$3^1 = 3$
2	$3^2 = 9$
3	$3^3 = 27$
4	$3^4 = 81$
5	$3^5 = 243$
6	$3^6 = 729$
	1,093 People

Number of Interfaces
= $\frac{1}{2}(1,093 \times 1,092) = 596,778$

When the situation is made just a bit more complex (Figure 3) —but still not as complex as the organizational charts in many enterprises—with six levels below the top and a span of control of three, one finds 1,093 people, with 596,777 possible interactions. This makes it difficult to determine:

- Which interfaces are necesary?
- With whom to link? When? How often?
- Who depends on whom—who are the customers and who are the suppliers in the potential relationship?
- What are the customer's requirements? What are the supplier's capabilities?

To further complicate matters, these questions must be answered in the context of a dynamic external environment. Finally, this illustration doesn't capture the intensity of the frustration and conflict that usually accompanies process failures and makes them even worse. People's feelings about the organization are intimately and intricately interwoven with its quality capability. Fragmentation of the process not only wastes large amounts of the enterprise's productive resources, but also replaces the satisfaction that comes from success with a feeling of personal failure and its correlates, frustration, blame, recrimination, and conflict. People give up; most people in large organizations are not entrepreneurs and will not persist or challenge the bureaucracy when faced with adversity, they lose their commitment to the organization and their trust in management.

What type of transformation is needed?

The culture of an enterprise is shaped by the products and services the organization provides. Furthermore, cultures vary among the functions of a single firm, depending on the amount of repetition and stability or creativity and innovation required. One of management's critical tasks is to create a vision of where the firm should be to thrive, define the current state of affairs, plan how to move toward the vision, and then do it. People in the enterprise must be taught to cope with change so rapid it seems continuous, the capability to accelerate needed internal change is a key to competitive viability.

Competitive viability demands a culture of unity with flexibility, of autonomy with collaboration, of stability with change. The enterprise needs new images of organization—or rather old images. Many large firms started out as small entrepreneurial activities. People who were there at the beginning may remember the early days of the business—the closeness of the people, the ability to communicate face to face, the dedication and spirit, the absence of rules and procedures. A few people executed all of the business functions. They knew the customer and they knew that their purpose was to serve the customer. They were innovative and able to change to meet the changing needs of the customer. But as success led to growth, external complexity was matched— even exceeded—by internal complexity resulting from attempts to achieve control by specialization and fragmentation into functional provinces. The characteristics that made the firm successful—innovation, quick response, ability to change—were lost.

The enterprise needs to bring back this capability. While it needs sufficient internal stability to reproduce goods and services consistently for the markets it has created, it needs an organization that is loose enough—sufficiently flexible and adaptive—to respond to the demands and opportunities created by external change.

If the enterprise is to become competent in dealing with external change, its processes—their parts and the relationships between them—must be able to change. People, as part of interdependent processing systems, need to have the autonomy and capability to reorganize themselves, to form and reform the process connections to change what they do and how they do it to meet new and changing external conditions. As the networks reform, the specific interfaces may change along with the mutual requirements of suppliers and customers who make up the interfaces.

Under these circumstances, stability will come to refer more and more to processes of managing change, rather than to preventing change. Thus, the enterprise needs new models, images, and principles of organization and management. Table 1 is an attempt to define both ends of a scale that ranges from a tightly controlled, rigid enterprise that is not good at dealing with external change to a flexible organization with the ability to keep up with a changing environment.

There is no single right way to accomplish the transformation from a rigid bureaucracy to a flexible enterprise. Moving from vertical, functionally oriented management principles, systems, and structures to lateral, process-oriented ones requires a new perspective about what it means to manage and control; in the new economic age, everyone in the enterprise can be viewed as a process manager. This movement also requires thinking in terms of wholes and relationships rather than functions and fragments, the hierarchy can be viewed as a network of processes, as shown in Figure 4, rather than a collection of functions. Many paths lead to this desired vision. It is a process of discovery and learning.

The initial challenge is education. Change is a process of learning, of gaining new knowledge and skills. It must be preceded

Figure 4. Hierarchy of Process Networks

Supra Process Manager

Process Manager

Subprocess Manager

Tasks
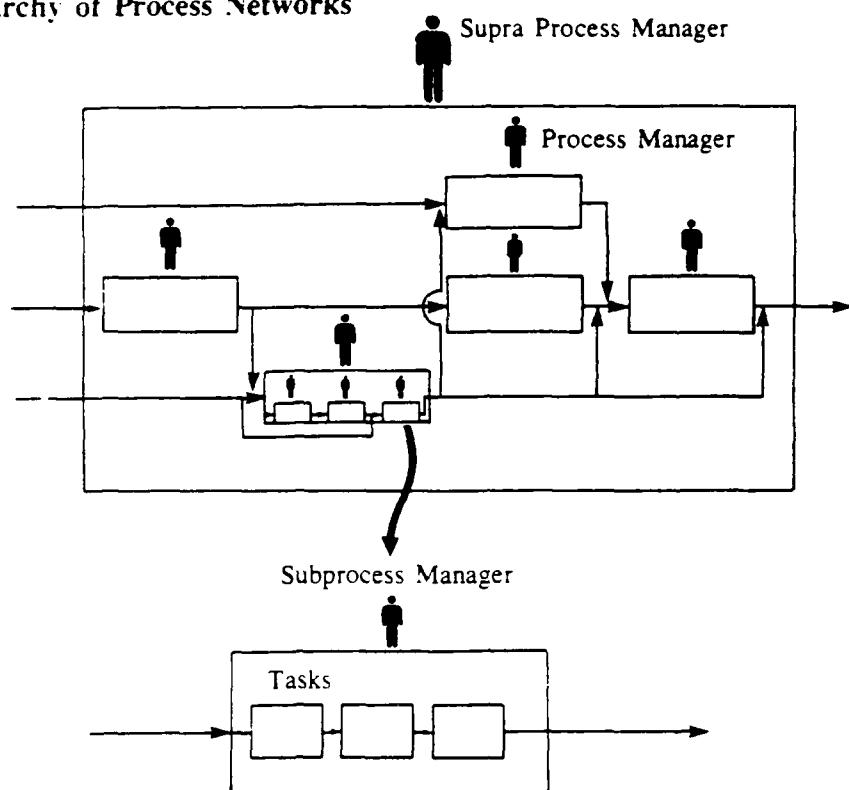
ry learning how to learn; learning to remove the barriers to learning. Children are good learners because they have little in the way of preconceived notions to block and filter out ideas. Adults often have difficulty learning because new ideas conflict with existing habits, values, beliefs, etc., which once served a need or function but now must be unlearned or discarded. People in the enterprise need the ability to know when former ways no longer serve the purpose of the organization and must be changed.

Consider how a person learns a complex skill such as playing a musical instrument, speaking a foreign language, or driving a car. Initially, the new driver holds tightly to the wheel. While trying to maintain a straight path, the learner over-steers in one direction, then tries to compensate by over-steering in the opposite direction. Driving along the highway or merging into traffic, the novice disrupts the other drivers and interferes with the smooth flow of traffic. But, as the learner becomes competent, control actions are fewer and more subtle; transitions from one activity to the next are smooth. The individual is in harmony with the external environment rather than disrupting it. In today's world of rapid change, the functional bureaucracy often behaves like a new and still unskilled learner, over-adjusting, unable to make smooth linkages between segments of the process, unable to operate in harmony internally and with the external environment. But how can the bureaucracy learn when traditional systems, principles, and structures were designed to prevent learning and change?

In these circumstances, even people of good will seem unable to do anything about the fragmentation of the enterprise and the associated cycle of waste and frustration. People tend to look upward to their bosses, downward to their subordinates, and sideways to their cousins in other functions for the solution (or blame).

The challenge to the enterprise, especially at the top, is to let go of the archaic ways of thinking about how to organize resources. Existing structures cannot and should not be dismantled overnight; rather, the process should be one of stable change as the organization learns what new forms to take through planned observation, experimentation, and study (as shown in Figure 5). But, certainly people can learn to operate as if they were part of an interdependent system with a common purpose rather than a collection of independent units.

Components of the transformation

How can we accomplish the transformation needed to maintain competitiveness in the face of external change? There is no one way, but some basic characteristics of the flexible, adaptive organization can be described.

1. The enterprise has defined its purpose and desired quality culture. These are critical first steps in the transformation. These steps often are overlooked or not specifically addressed because they appear so simple. They are important for two reasons. First, they require discussion and clarification at the top of the enterprise and subsequently throughout the entire organization. Second, they help top management decide if it really wants to change. Without top management belief that change is necessary, there won't be the leadership to energize the rest of the organization.

All of the enterprise's systems and activities derive from its purpose, its reason for existence. A quality-oriented purpose should be conceptualized and defined in terms of the customer. The culture defines how people are expected to behave; what's right and what's wrong. It provides norms and principles to guide the behavior and judgment of members of the enterprise. It states

Figure 5. Scientific Method for Learning About and Improving the Processes of the Enterprise

Deming's Continuous Transformation Cycle*

Team Leader

Assess what was learned.
Decide what
to do next:
• Continue the study
• Change the process

4.   1.

3.   2.

Team Members

Old Process

Observe the
Effects

Plan the:
• test/experiment
• process change
  pilot study

Carry it out

New Process
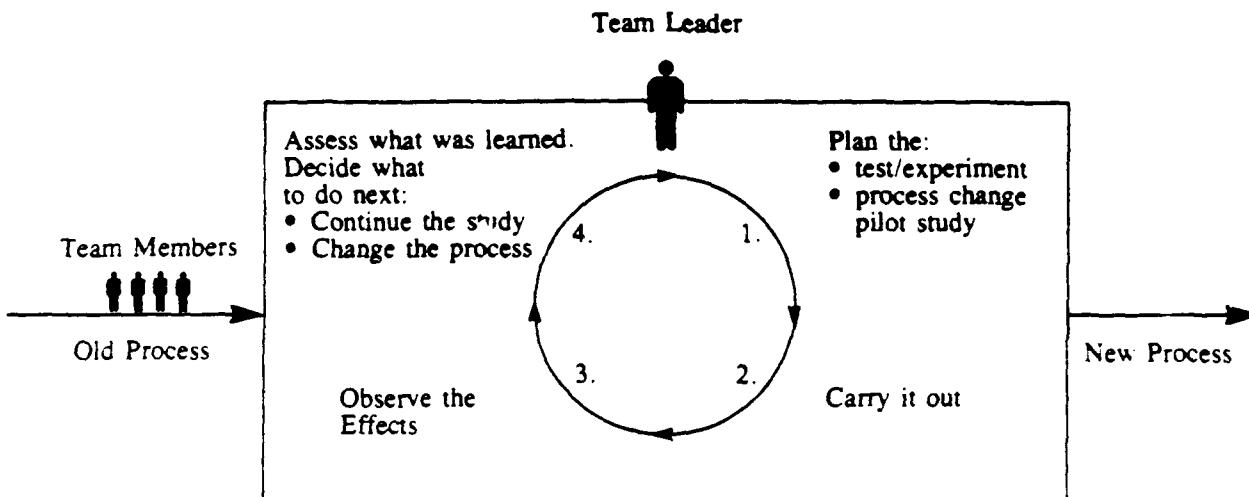
*See Deming, 1986, p. 88; See Juran's (1964) Breakthrough Sequence

values regarding people, product, and service: how customers and suppliers are to be treated and how everyone in the company should treat one another. It enables people to make decisions in the best interests of the enterprise when faced with new situations It provides guidance for redesign of the enterprise's systems.

As the purpose of the enterprise—and the principles guiding its transformation—are communicated through the organization, people may observe contradictions between the vision of how things should be and the reality of the way things are. These contradictions will arise. but it must be understood that the vision is an ideal to work continually toward rather than something that always will be achieved. As the enterprise moves away from bureaucratic modes of operation, people will find it easier to live according to the desired values. The vision of purpose and culture should be reevaluated periodically as the enterprise learns more about itself from its customers, and its members, and as the environment changes.

2. Quality improvement planning is integral to the long-term health of the business. Because such planning provides resources and accountability for the process of change, rather than merely for today's results, it balances today's needs with tomorrow's.

3. Processes are managed as integrated systems—that is, they are seen as flowing laterally, without regard to provincial boundaries, rather than as a static collection of separate functions. Integration refers also to the melding of the social and technical systems. Improvement is accelerated when individuals:

• have a holistic view of what they do and where they fit that goes beyond their own discipline, specialty, and functional province.

• understand the enterprise as a network of processing systems in supplier-customer relationships.

• understand that the quality culture is customer driven. The

supplier's process requirements are derived from—and are surrogates for—the customer's requirements. not the supplier's needs. On a larger scale, the enterprise is not its own customer, adhering to its own specifications, oblivious to the changes in the outside world.

• understand that they and others in the organization have obligations and responsibilities resulting from each person's dual roles as customer and supplier.

• define teamwork as collaboration between customers and suppliers to meet customers' needs and improve the suppliers' capability to meet those needs.

• view customer needs as positive requirements to be actively achieved rather than as negative product and service characteristics to be avoided.

4. The purpose, management principles, and culture of the enterprise are the bases for changes in the system—changes accomplished by getting everyone involved in improving the processes that they manage. All people, management and nonmanagement. feel responsible for, and participate in, process improvement studies. The micro-systems of the specialists and the macro-systems of the managers are subject to the same improvement principles, processes, methods, and tools. These methods are applied at a level of understanding and detail appropriate for the complexity of the processes over which the individual presides

5. The learning process (Figure 5) underlies the planned and stable change of all systems: technical, social, and management The Deming-Shewhart cycle[3] and Juran breakthrough sequence[4] are examples of the "scientific method" that can be used to teach everyone in the firm to learn how to learn. It is extremely effective when applied by process improvement teams of suppliers and customers, whether on the shop floor, in the engineering office. in the finance office, or in the executive suite.

Planned change is data-based and therefore requires statistical theory and methodologies to determine if there is a stable baseline from which to plan and evaluate change—if there is evidence of a system of multiple, common, interdependent causes that can be studied and changed, or rather of a series of somewhat unpredictable, even chaotic events indicating that a system doesn't even exist.

6 Planned change is also emotion-based—it takes into account people's feelings and fears about how the change will affect them. (Will they be hurt or will they benefit? Can they trust a changed future to be better than the present?) Even when people understand that change is necessary, it is often difficult for individuals to change personally for two reasons:

• They do not believe that change will improve their own lot in life

• They do not believe that they can participate in bringing about positive change

These feelings are rooted in the nature of the functional hierarchy. For years, employes (including middle management) have been conditioned to believe they cannot and should not control events and that their lives are in the hands of others—that the "system" will handle it. This is especially true in large companies that have reached middle age and substituted procedures for personal relationships based on mutual trust and common purpose. People are too embedded in the functional provinces to break out on their own, even when they want to and know they ought to change. They are afraid of change; history has robbed them of the confidence that they can create a favorable future, and it has not provided the process for gaining and applying the knowledge needed to plan and create change.

A "third party" (internal or external) can help break down the provincial barriers and create the mutual trust needed for collaboration. It is unreasonable to expect this to come from within the provinces and their members—they need outside help plus the leadership of top management to create a positive vision of the future.

Implications for the quality professional

Quality traditionally has been viewed as the technical province and responsibility of people in the "quality department." The "quality professional" as a member of the quality department, has operated in and supported the types of systems defined by the left side of Table 1. The job was designed for a world of stability and certainty. Tactics have focused on detecting, removing, and preventing nonconformities in order to forever meet the specifications. The emphasis has been on avoiding negatives rather than on achieving positives through continuous assessment of customer needs and improvement of processing systems to anticipate and meet those needs and strengthen customer loyalty. As change becomes a way of life inside the enterprise, quality strategy and methodologies that have been concerned with maintaining stability will have to be altered to promote change. The customer's threshold for quality is continually being raised. While zero defects may be the producer's end goal, it is the customer's minimum expectation. It does not assure competitive advantage. It gets the enterprise a spot on the starting line, but doesn't guarantee winning the race.

Quality will come to be understood as inherent in every process and the responsibility of every person as a "process manager." The transformation, therefore, will involve the entire enterprise, treated as a whole, rather than as disconnected programs. The traditional domain of the quality professional, however, has been the manufacturing operation. Competitive viability requires that quality principles and concepts encompass all of the firm's func-

tions and activities in a holistic, integrated, process-oriented manner. The interfaces that link process to process are as critical as the processes themselves. A process has no purpose if its products and services do not serve a customer, and a process cannot serve a customer if it does not receive what it needs from its suppliers. Every function and every individual in the firm participates in the organization's processes as a supplier and as a customer: everyone can benefit from an education in the generic quality principles and methods that can be applied to improve any process and its relationships with other processes. The role of the quality professional will have to expand to one of consultant to management throughout the enterprise.

The transformation will be social as well as technical. Process interfaces should be viewed as relationships between people, which involve feelings and interpersonal communication. Quality professionals traditionally have not been involved in creating the social-cultural conditions needed to develop and nurture teamwork, collaboration, and personal commitment to other colleagues in the enterprise. People's feelings and opinions about each other and about the firm reflect the social effects of the firm's systems and can provide valid indications of what needs to be changed. This implies that the quality professional will have to treat these "soft" data as valid information and learn appropriate methods for analyzing them.

The failure to create supportive social conditions is documented by the failure of most American attempts to transplant Japanese quality circles into the soil of American business culture [8] Circles didn't take root because the management, technical, and social systems were mechanistic and fragmented. Companies tried to install the circles rather than create the climate needed for them to grow. Many of these attempts were managed within the domain of quality control. Sidney Rubinstein has tried (unsuccessfully for the most part) for more than two decades to help his colleagues in the quality profession recognize that a total quality system must explicitly integrate the design of the management and technical systems with people's needs, desires, and abilities [9] It follows that quality can benefit from the involvement of employes in the design and change of the systems within which they work. In most firms, improvement of the work climate, especially through employe participation, has been the responsibility of industrial relations managers and human resources specialists. Where employes are represented by a union, management-employe relationships have been addressed within the traditional structures and roles of professional industrial relations and union intermediaries. Rubinstein's work has demonstrated that processes and structures can be redesigned to create new collaborative roles and relationships with the direct participation of all management, union, and employe stakeholders. [10]

Enlightened senior managers in major North American companies are starting to view quality as a generic business function. [11,12,13] Quality professionals have been instrumental in designing and carrying out transformation activities within a number of firms: process-oriented thinking has been used to integrate business functions and improve quality and productivity within a highly layered, vertical management structure. [14,15,16,17,18]

These are initial efforts to overcome the bureaucracy and represent a continuing process of learning and change. The number of firms undergoing this type of transformation will undoubtedly grow rapidly in the next decade. There is no alternative. During the past decade, the Japanese have developed quality function deployment [19] to integrate the functions of the business within the framework of company-wide quality control. This discipline is being studied by a growing number of North American companies.

In order to guide all members of the enterprise through the

transformation, the quality professional will have to work with other change agents to educate and train, consult, and remove barriers to change while promoting creativity and innovation. The quality professional's effectiveness will be enhanced by participation in the following interrelated activities:

1 Development of communication and influence networks. An alliance of quality professionals, statisticians, organization development professionals, training specialists, and other experts can collaborate as an internal resource team, even if members are not in the same organizational unit. External consultants can be considered part of the team. In addition to helping the internal consultants with strategy and tactics, they can promote transformation at the top of the organization by playing a role that management might be unlikely to accept from internal experts, even if technically competent. Organization change consultants can diagnose the strengths and weaknesses of management styles and relationships at the top of the organization and provide the feedback and guidance that must precede effective change. They can help top management define the enterprise's purpose and culture, plan the broad change, and provide feedback to the executives regarding their own performance in managing change. Statisticians (Deming-type) can help management understand that improvement lies in changing the systems of the enterprise.

The quality professional should also develop an internal network of implementers, which can help build a critical mass, particularly if it includes key staff and line managers and is linked to the network of specialists and to the top management teams leading the transformation. At the same time, an external network of people in other companies attempting a similar transformation can accelerate learning about useful approaches.

Similarly, the top executive, who has no "cousins" within the firm, can benefit from mentoring by a cousin from another company who has been through a similar change process and is willing to help the senior executive. The mentor can help clarify the top executive's role and create realistic expectations of the normal ups and downs that occur during times of change. External consultants should be able to find mentors in their client firms.

2. Consulting skills improvement. Quality professionals may come to view themselves as representing the desires and vision of top management, but this doesn't guarantee acceptance by others in the organization: people may say that they are in total agreement that the firm is on the right path and would love to participate, but that day-to-day pressures take priority. The consultant must know how to "sell" the advantages of process improvement. A consultant must also know when to try a different approach. Unwillingness to participate may be caused by fear of change.

Internal change agents should become educated in methods of large system change, particularly with regard to people issues,[20,21,22,23] as well as gaining competence in techniques of small group management.[24,25,26] These skills will be useful in managing process teams whose members will likely report to different functional managers.

The conduct of process studies will be improved by learning more about Deming's statistical theories, general systems theory, and the "scientific method" exemplified by Deming's continuous improvement cycle and Juran's breakthrough sequence, both of which are processes for discovering what aspects of the system to change.

3. Promotion and marketing. The quality professional must constantly educate others in the company, especially people outside of manufacturing, about the new role of professionals in the quality organizations and the multidisciplinary approach to change. This includes advertising successes by multimedia documentation, especially videotapes.

Finally, the quality professional should have influential and committed managers educate their colleagues in the firm.

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Edward M. Baker has been with the Ford Motor Company since 1972. He is statistical methods manager, corporate quality and engineering services staff. In this assignment, he is responsible for developing approaches for worldwide implementation of Ford's efforts to improve quality and productivity. Baker is a Fellow of ASQC and the author of numerous papers on quality and productivity, including "Managing Human Performance," which will appear in the fourth edition of Joseph M. Juran and Frank M. Gryna's *Quality Control Handbook*. He received his BA from City College of New York, his MBA from the Baruch School of Business Administration, C.C.N.Y., and his PhD in industrial and organizational psychology from Bowling Green State University.

1-3

The Quality Manager's New Job

Brian L. Joiner and Peter R. Scholtes

The Quality Manager's New Job

Management by control must be replaced by total quality leadership throughout the organization

by
Brian L. Joiner and Peter R. Scholtes

FIGURE 1

MANAGEMENT BY CONTROL
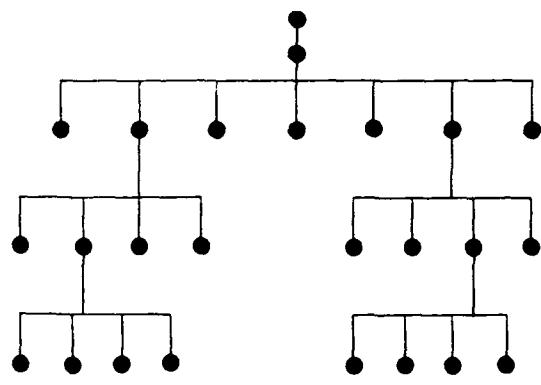
A MERICA FACES A DEEPLY troubling future. We are in the midst of a transition to a world economy increasingly dominated by the Pacific Basin countries, a turnaround in the economy from the red-hot inflationary years of the late 1970s, and a revolution in technology that is altering battle plans on nearly every front every day. America is struggling in a world where companies, governments, and organizations have to run fast and smart to stay alive.

Many American companies are in trouble—losing old customers and failing to find new ones. Yet many managers cannot comprehend what is happening or why.

Manufacturers have been hurt badly by foreign competition that is producing higher quality goods at lower prices. Many firms—both manufacturing operations and service companies such as airlines and banks—are facing chaotic market conditions as a result of deregulation. State and local governments, already subject to cutbacks of federal funds, struggle to make up revenues through higher taxes. State is pitted against state in competition to attract jobs.

We believe that one major cause of these problems is the failure of American managers to realize that there is a "new" way to manage their organizations—a way that yields much higher quality, higher productivity, more jobs, and better return on investment. We call this system of management "total quality leadership."

Total quality leadership is a way of managing any organization—whether it be a Fortune 500 corporation, a university, or a family restaurant. Total quality leadership can create sustained growth from the chaos of today's marketplace. With total quality leadership practiced throughout the economy, America can regain its competitive position in the world market.

Quality managers can do a great deal to help their companies learn and implement the new approach. But to understand total quality leadership, we must first examine what we call "management by control," the most common form of management practiced in American companies today.

American managers, for the most part, are a tough lot who have accomplished much. They have helped build the strongest economy the world has known. And yet they are losing control. They have not used the full potential of their organizations. They have failed in many respects to satisfy their customers, and so they are losing these customers.

Most American managers manage, at least in part, by management by control. In this style of management, the emphasis is on the organizational chart and the key control points within that structure (Figure 1). All managers, beginning at the top, are given certain goals for the next year. They, in turn, set goals and impose controls on each of their subordinates. A CEO, for example, may simply be given a profit objective. He or she will then typically give each division head a profit objective. A division head then has to set goals or quotas for each department head. In a manufacturing organization, the sales department may be told to increase sales by 10%, production to increase productivity by 5%, engineering to get products into production 10% faster, purchasing to reduce costs by 5%, quality to decrease warranty costs by 20%, and so on. At the lower levels, these goals become quotas or work standards.

Management by control is simple, logical, and consistent. It seems to have been quite successful. It is practiced by nearly every major American corporation. It is widely

taught in business schools. And it is credited by many for getting us to where we are today.

But there is an underside to management by control. Consider these examples.

- An electronics firm typically ships 30% of its production the last day of the month. Why? In order to meet the monthly shipment quota. How? By expediting parts from around the country, by moving partially completed instruments ahead of their place in line—and, occasionally, by letting quality standards slip.
- Another firm sometimes ships incomplete instruments. A service representative then flies around the country installing the missing parts. The shipment quota for the month is met again. Profits, at least on paper, hold firm.
- A chemical plant reports it cannot run efficiently at the mandated inventory levels, so it keeps inventories higher until June 30 and December 31, when inventories are measured. For those days, it depletes the inventories to an acceptable level, perhaps losing two days' production as a consequence.
- Many managers annually negotiate safe goals and manage to exceed them, just barely. Some managers include, on their list of negotiable goals, items that were already secretly accomplished prior to the negotiation.
- Production that exceeds the standards is stored so it can be pulled out and used another day.
- A meter reader stops at a tavern at two o'clock rather than exceed his work standard.
- Problems are hidden from management, in hopes they will blow over and not be noticed.

These are just a few examples of problems that occur with management by control. It has many shortcomings. Most occur because the larger purpose and greater good of the work being done gets displaced by the controls themselves. The workers, supervisors, and the managers get caught up in organizational pretense: looking good overshadows doing well.

Why do these problems arise? Here are but a few of the many negative aspects of management by control:

- It is a system of controls. The rewarded accomplishments are therefore necessarily measurable and short-term. The near horizon gets attention and countable accomplishments get priority even though an organization's survival may depend on the unmeasurable activities undertaken to accomplish long-term results.
- Systems of controls operating without a long-term, larger purpose will always heat up conflict in an organization. The controls that direct one unit's short-term gain will contradict the controls that direct the short-term gains of another unit. Sales will make promises which production can't keep. Engineers will rush products into production before they are ready. Purchasing will buy materials the warehouse can't store and the people on the line can't use. Planners and policymakers plan programs that service personnel aren't equipped to provide. Each group struggles to conform to its controls independently of other groups, and sometimes at their expense.
- When measurable controls are unattainable or impractical, individuals and groups tend to fabricate conformance. They "play the game" because not to do so would cause them to risk looking bad. The twice-per-year depletion of inventories is a movie-set approach to conformance. Behind the appearance, there is no substance. But it looks like controls are in effect.
- This charade of conformance fosters guarded communi-

cations and minor—even major—dishonesty. The greater the stress on reaching unattainable goals, especially when someone's career is on the line, the more likely it is that the figures will be juggled.

- The inevitable contradictions between the controls of different departments lead to finger pointing, blame games, and an endless series of excuses like, "If it weren't for them...."
- Related to the blame-it-on-them mentality is a cover-your-rear mentality: play it safe, don't trust anyone, and make sure that when the system breaks down, someone else is at the switch. In times of stress, circle the wagons; don't help others, especially if they're under fire.
- Behind the worst shortcomings of management by control is fear. Fear is the prime motivator in a management by control system. And the more rigid and unrealistic the controls are, the deeper is the fear.
- Management by control encourages an organization to look inward at its own structures rather than outward at the world in which the customer operates. Rather than delight in providing a product or service that works and satisfies the customer, the sense of accomplishment comes from meeting the controls. It becomes a self-reinforcing cycle. A manager or supervisor has a goal imposed on him or her. The manager works to meet that measure, however much distortion might occur at some other time or place in the organization. Meeting the short-term measurable goal is an indicator of the success of the individual and the success of the system of controls. Thus, there is fostered a Titanic-like complacence about the invulnerability of the operation. When there finally is some awareness that the indicators of control may be focused on the wrong measurements, it's too late. The ship is going down and "Nearer My God to Thee" is heard from the afterdeck.

IT IS INTERESTING TO NOTE that management by control is widely used in the Soviet Union. Typical is this story. Several years ago there was a surplus of large nails and a shortage of small ones. Why? Managers were held accountable for the tons of nails produced. Later the control was changed to the number of nails produced. This led to a shortage of large nails, since smaller nails gave higher counts.

Managers often say, "I agree, there are serious problems with management by control, but what is a better alternative?" The alternative, we believe, is total quality leadership.

Simply put, total quality leadership is an approach to management which focuses on giving top value to customers by building excellence into every aspect of the organization. This is done by creating an environment that allows and encourages everyone to contribute to the organization, and by developing the skills that enable them to study scientifically and constantly to improve every process by which work is accomplished.

In all organizations there are processes by which things get done. There are processes of production, of sales, and of distribution. There are also processes to find out about customer needs and problems. There are processes that couple market information with information on new technologies. These in turn generate ideas for new products and services. Other processes create and test these new products and services and move them into routine production. Still other processes study costs and value added throughout the organization. There are literally thousands and thousands of processes, the overall health of which determines the future of the enterprise.

FIGURE 2

TOTAL QUALITY LEADERSHIP
The Deming Way

Suppliers

A
B
C
D
E
F
G

Design and Redesign

Consumer Research

Consumers

Distribution
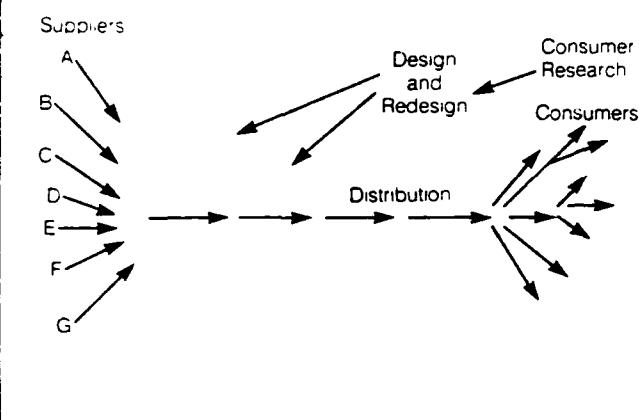
FIGURE 3

Quality

Scientific Approach

All One Team

In total quality leadership, the emphasis is on studying these processes (Figure 2) and on executing them better and better to provide customers with products and services of ever-increasing value at ever-lower costs.

The focus in total quality leadership is on quality—the quality of every product and service and the quality of every process. This emphasis on quality is shown at the apex of the triangle in Figure 3.

To achieve this higher quality, every process, beginning with the most important, is studied using the scientific approach. Processes are described with flow charts, problems are identified, the root causes of problems are determined through careful research, and new fool-proofed systems are developed. Every process is brought under statistical control and variations are further reduced, well beyond specifications.

The use of the scientific approach, as shown at the bottom left of the triangle in Figure 3, becomes pervasive.

In many cases, the most difficult aspect of total quality leadership is to create an environment of "all one team." If a company is to be truly excellent in every activity, everyone throughout the organization must work together to improve processes and to execute them with energy and efficiency. It requires a fundamentally different view of the relationship between employes and the organization. In order for all employes to be committed to the organization,

the organization must be committed to its employes. This environment of total teamwork cannot be developed under management by control.

Total quality leadership is not widely practiced in the U.S., but it is not new, nor is it foreign. Its roots go back to the early 1900s and its principal prophet is a Sioux City Iowa, native named W. Edwards Deming. A statistician by training, Deming formed many of his theories during World War II when he taught industries how to use statistical controls to improve the quality of production.

But when the war ended, American industry turned its attention to meeting the huge demand for consumer goods without the pressure for efficiency or quality that guided it through the war years. And for almost 20 years there was no foreign competition.

Across the Pacific, however—where "Made in Japan" meant junk—there were people willing to listen. Deming told them to find out what their customers wanted, then to study and to improve their product designs and production techniques until the quality of the product was unsurpassed. He taught them the product was "still in the development process when it was in the customer's hands."

His influence began with a dinner meeting in 1950—organized by the Union of Japanese Scientists and Engineers—with 45 leading industrialists at the industry club in Tokyo. He has since recalled that meeting.[1] We will quote his recollections here extensively, since they are so central to his thesis.

> They thought they could not (compete) because they had such a terrible reputation for quality....I told them "You can produce quality. You have a method for doing it. You've learned what quality is. You must carry out consumer research, look toward the future, and produce goods that will have a market years from now and still stay in business...."
>
> Incoming materials were terrible, off-gage and off-color, nothing right....I urged them to work with the vendors and to work on instrumentation. A lot of what I urged came naturally to the Japanese, though they were not doing it. I said, "You don't need to receive the junk that comes in. You can never produce quality with that stuff. But with the process controls that your engineers are learning about—consumer research, redesign of products—you can. Don't just make it and try to sell it. But redesign it and then again bring the process under control...with an ever-increasing quality."
>
> I told them they would capture markets the world over within five years. They beat that prediction. Within four years, buyers all over the world were screaming for Japanese products.

The rest, as they say, is history.

HERE ARE SOME OF THE KEY components of total quality leadership.

• It recognizes—as Joseph Juran has argued since the early 1950s—that at least 85% of the failures in any organization are the fault of systems controlled by management. Fewer than 15% of the problems are actually worker-related. In total quality leadership, the focus is thus on constantly and rigorously improving every system.

• It asserts that work is not haphazard. It can be and must be studied, analyzed, and scientifically dissected.

• It insists that processes must be standardized and the standardized procedures must be followed. Variation must be reduced in output and in the way things are done, yet the

opportunity must be provided for everyone to contribute to improving the processes and to eliminating problems.
• It has a customer focus, an obsession with quality.
• It recognizes that you have both external customers and internal customers—other employes who depend on your work to be able to perform their jobs properly.
• It demands improved relations with suppliers, a true working partnership, which in most cases will require a single supplier for each item.
• It emphasizes process improvement rather than individual accountability.
• It requires that communication systems be adapted to the needs of the work, not the needs of the hierarchy.
• It demands constancy of purpose throughout the organization, persistence in accord with a clear and widely understood vision. It is an environment that nurtures total commitment from all employes. Rewards go beyond simple benefits and salary to the belief that "we are family"— that "we do good work."

Total quality leadership is a management philosophy that starts with the customer, not with the bottom line or the profit-and-loss statement.

It is very data-oriented and calls for monitoring thousands of variables inside and outside the organization. These numerical measures are used to guide the search for better performance, and are recognized as means rather than ends—as guides to deeper truths rather than items to be controlled.

In total quality leadership there is freedom, yet there is control. There is the freedom to discover new markets, to develop new systems, to gain greater mastery over the processes. And there is the control of a data-based approach to improvement.

Many managers have great trouble understanding why they should focus on improving the systems that serve the customer rather than simply on profits. The Deming chain reaction in Figure 4 may help. When quality is increased by improving processes (not by expanded inspection), the better quality will lead to improved productivity. This leads to lower costs, which lead to lower prices. Better quality and lower prices mean the company can expand its market, and can stay in business creating jobs and a greater return on investment.

Management by control, on the other hand, tends to focus only on the end result—the return on investment; it is like wagging the tail to keep a dog healthy. This is a tough concept to comprehend. It takes a leap of faith to make the fundamental shift from management by control to total quality leadership. There is no easy way to make the change. It seems best to us to use a gradual process of letting go from the old style while embracing the new.

Mary Ann Gould, president of Janbridge Corp. and the leader of the Philadelphia Area Council for Excellence, thinks of it as a "revolution in thought," and an "evolution in implementation."

Working partly in collaboration with Gould, and receiving considerable advice and counsel from Deming, we have developed a general model for implementation. Our model is not static as we continue to learn by working with a variety of organizations seeking to make the transformation.

Key elements of this model include:
• *The education and re-education of managers.* They must become leaders instead of bosses, coaches instead of enforcers. They must focus on solving problems and constant improvement instead of blaming and controlling. The

FIGURE 4 DEMING'S CHAIN REACTION

Improve quality → Improve productivity → Decrease costs →

Decrease prices → Increase market → Stay in business →

Provide jobs and more jobs → → → Return on investment*
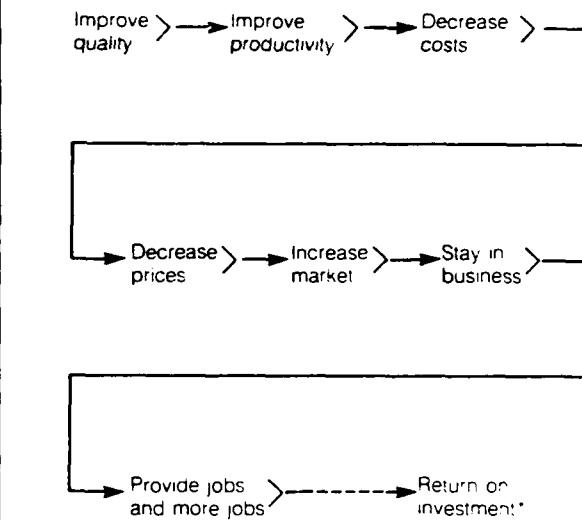
*The last element. "Return on Investment" has been added by the authors.

quality-focused approach to leadership requires continuous feedback from the customer, and constant communications and feedback within and between units of the organization.
• *The development and communication of a clear vision of the organization's future.* It is a vision that says: here is what we are, here is what we do, here is where we're heading, and here is what is important and unique about us.
• *The formation and development of true management teams.* They are essential for leading the company in its normal business functions and for leading the implementation of Deming's approaches so that total quality leadership itself becomes a "normal business function." Teams are essential for maintaining "constancy of purpose," for "breaking down barriers" between departments, and for "driving out fear" among the managers themselves.
• *Targeted implementation efforts and an overall strategy.* A common mistake is for companies to try to involve too many people too soon in the improvement efforts. It is easy to plant a big garden, but very hard to tend it, harvest it and make good use of the crops. Don't begin more improvement efforts than you can realistically support and maintain.
• *Management-selected projects and project teams using the scientific approach to improve processes.* Usually the teams consist of a mixture of professional staff, managers, supervisors, and hourly employes who use scientific methods to study and improve processes.
• *Developing or recruiting key resources,* including a senior statistician, a senior organization development specialist, and intermediate-level resource people who are trained in both statistics and organizational development to coach project teams. They play a special role in assisting the transformation by providing help with the scientific investigation of processes and by facilitating the dramatic changes in the organization, its management, and its culture.

• *Leadership, participation, and oversight by managers, beginning at the top.* This is an absolute essential. The most frequent cause of failure of any quality improvement effort is the noninvolvement or indifference of top and middle management. Passive support is not enough. Total quality leadership must involve everyone.

• *Developing champions* who will help the transformation succeed even during rough periods.

Total quality leadership is, as Deming puts it, "Nothing less than a complete transformation of the Western style of management." Quality managers can play an important role in helping their organizations make this fundamental transformation, but new skills will be needed.

The quality manager's new job—like everybody else's—is to help this transformation. All of the parts that make up total quality leadership—the management teams, the statisticians, the organizational development experts—have to be supported.

These functions can best be done, we believe, if they are centralized in a small but very important department, which, for want of a better name, we call the "process excellence department." The department helps make certain that everyone in the organization is aware of not just what is happening in the improvement effort in the company, but also what changes are taking place in other companies. It helps with the education and re-education of managers by locating appropriate seminars and workshops and by bringing people in from the outside.

The members of this department should be the leading champions of the transformation. The department takes the lead in showing others how blending an obsession with quality, unprecedented levels of teamwork, and the use of the scientific approach through statistical tools lead to major ongoing improvements in the quality and productivity of products and services. They must be sensitive to, and know how to handle, the cultural dislocations that inevitably accompany such big changes. They must develop systems to assist top managers in tracking activities associated with the organization's transformation.

In the new era of total quality leadership, the process excellence department can play a vital role. Some quality managers may aspire to fill a role in this department.

For quality managers who want to contribute to the transformation to total quality leadership, there is much to learn. If you haven't already done so, we suggest you read the books of Deming, Juran, Ishikawa and papers by Tribus and Fuller listed below. Attend the four-day seminars by Deming and Juran. Visit Japanese-managed companies here and abroad. Expand your knowledge of statistics and organization development.

Remember, the best way to get others to change is for you yourself to change. Begin with your own work. What can you do to improve the quality of your work and the satisfaction of your "customers"? Listen to your "customers" and to those with whom you work. In whatever decisions you make in your job, begin replacing educated guesswork with reliable data. Strive to eliminate blaming and replace it with problem solving.

Begin to practice the new approach with others in your department. Work with people to break down barriers and drive out fear. Help them study and improve the systems in which they work. Help them document the best known practices and provide effective supervision so they are conscientiously followed. Then help everyone continue to work and develop still better systems.

Deepen your understanding of management by control and come to recognize its limitations. Learn to see it in all its different guises.

Look at your own company. What are the forces that make things work? What dominates your daily work life—fear, or turf battles and constant pressure to meet quotas? Or is there cooperation and planning based on specific facts? Do you feel like a cog in the wheel or like an integral and important part of the process? Does the bottom line rule all? Or are the customer and quality of work the recognized goals of your company?

When you've done all this, you'll be in a better position to come up with some creative ways to think about how to help your organization move from management by control to the new way—total quality leadership.

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SECTION 2:

GUIDELINES FOR THE DEVELOPMENT OF TQM

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2-1

Managing Change: Implementing Productivity and Quality Improvements

Edmund J. Metz

Managing Change: Implementing Productivity and Quality Improvements

The current range of approaches for implementing improvement efforts is defined, and the various alternatives are evaluated.

Edmund J. Metz

In recent years, organizations have implemented productivity and quality improvement efforts to meet international competitive challenges. As an organization consultant, I have observed a predominant implementation pattern for such efforts. That pattern can best be described as too short-term, programmatic, and segmented to achieve enduring productivity and quality gains. To obtain lasting benefits, a strategically integrated, organizationwide approach is required.

My purpose in this article is to share some general observations of how organizations are approaching productivity and quality improvements, describe some of the limitations of the predominant implementation pattern, identify what needs to be done better, and develop a scenario of some desirable future state characteristics by which productivity and quality improvements are strategically linked and enduring.

Implementation patterns

A large midwestern electronics company has had a formal "productivity" program under way for the last five years. A number of different programs were approved by a management productivity council, yet the results have fallen somewhat below management's expectations. During those five years, over a dozen different and independent departmental efforts to improve productivity were started, while the company went through three presidents and continued to experience headcount reductions due to declining market share. Business pressures encouraged a strong short-term focus on results and the technical orientation of management resulted in an abnormally high infatuation with measurements and control.

When I first became acquainted with this orga

*Far too many improvement efforts will fail to tap
the full extent of potential opportunity gains.*

nization over two years ago. I thought the situation was somewhat unusual. However, a number of organizational situations I have since seen or heard about lead me to conclude that many organizations have had similar experiences in implementing productivity and quality improvements.

The theme for this article initially grew out of two questions I had been asking about improvement of productivity and quality: "What are companies doing?" and "How are they doing it?" I asked these questions of representatives of thirty-eight Fortune 500 companies that are members of the American Productivity Center or the American Productivity Management Association. I detected three general implementation approaches, summarized in Table 1. Although the given commonality is the goals of productivity and quality improvement, the three general implementation approaches raise the important question of which approach would generate the productivity and quality gains most likely to endure over the long term.

Six key implementation characteristics

The majority of current efforts to improve productivity and quality will produce some results if only because of the Hawthorne effect. But while most will certainly produce some gains in the short term, far too many efforts will fail to tap the full extent of potential opportunity gains

My experiences in organizational consulting convince me that the potential for enduring, long-term success increases as one moves from left to right across Table 1, which summarizes the six most significant implementation characteristics for each of the three major implementation approaches. Unfortunately, it is the Type I approach on the left—programmatic and oriented to the short term—that is the most commonly used. Only a very small number of organizations are using the more strategic approach of Type III, on the right. However, I believe that Table 1 depicts what will be an evolution of organizational methodology from Type I to Type III. That is, I feel that all firms using Type I and Type II methodology will eventually, through trial and error, move toward adopting the characteristics of a Type III approach.

Below, the approaches are compared by examining their implementation characteristics.

Official banner

I have categorized the approaches companies are taking to productivity and quality improvement under three different banners. The most common banner is that which designates an improvement approach as a productivity or quality program (Type I) Another popular approach seeks to generate improvements under the broad banner of quality of work life (Type II) The third implementation approach (Type III), going under various banners, views productivity and quality improvements as consequences or products of a consciously designed organizational system or culture Most energy is spent in systems redesign and managing strategic change rather than in implementing programs at lower organizational levels

Although the selection of banners makes it appear that the three approaches are entirely distinct, in fact they merge into an evolutionary continuum, with some companies having characteristics that fit under more than one approach.

The simplification of reality by the use of a banner has both positive and negative consequences. It helps to give an approach an identity and thereby serves as a rallying point for people's efforts. However, banners can also limit or obscure what needs to be done

The difficulty with productivity program banners is that they create the impression that what they are describing is just another isolated program (which is now starting and will therefore also end once the productivity problem is "fixed"), and does not help people understand that some fundamental changes need to be made in work systems. Management's approach may be too programmatic to begin with, but the choice of banner can reinforce the problem.

Quality-of-work-life (QWL) banners are better in the sense that they serve as an umbrella for a broader and more all-inclusive effort, potentially encompassing productivity, quality, QWL, and sociotechnical systems change

A possible problem with some of the banners

Table 1

Organization Approaches to Implementing Productivity and Quality Improvements

Implementation Characteristics	Productivity/Quality Program (Type I)	QWL Program (Type II)	Organizational Redesign (Type III)
1 Official banner	Productivity or quality identified as main goal	QWL is main label, or productivity disguised as QWL	Varied individual labels—a holistic organizational view that may include OD and culture change
2 Measurements	Measurements emphasized	Measurements used	Measurements used
3 Methodology	Programmatic, with formal systems left in place and generally unchanged	Some programmatic features but also varying degrees of sociotechnical change	Systems redesign based on clear beliefs, philosophies, values, and the development of teamwork at all levels
4 Responsibilities and leadership	Delegated by CEO to others to implement; about ¼ of the Fortune 1000 have established a formal productivity person/dept.	Delegated responsibility, but with more active involvement of CEO and management	CEO actively involved in shaping new values and culture; high management participation at all levels
5 Degree of employee involvement	Some opportunities, but tending to be limited and voluntary, e.g.: —work simplification —quality circles —value engineering —communication programs	Broader range of involvement activities: —quality circles —participation teams —peer reviews —team building —gainsharing	Involvement by all people at all levels actively sought; generally not voluntary: —culture change —employee involvement —team building —statistical quality control
6 Strategic focus	Limited; improvement efforts usually not integrated with strategic planning process	Improvement efforts may be somewhat linked and integrated with strategic planning process	Improvement efforts clearly linked and integrated with strategic process

used for organization redesign (Type III)—e.g., Sociotechnical Systems, Organization Effectiveness, Open Systems Planning—is that because they are insufficiently descriptive, people may have difficulty understanding what the effort is really all about.

Measurements

As a general proposition, Type I companies tend not only to place the most emphasis on measurements but also to create and add new measurements to those already in existence. Additionally, a number of these companies have made frustrating attempts to develop a simple productivity measure that could readily convert all the organization's efforts to a final bottom-line number encompassing and accurately summarizing total gains and progress. Type II and Type III companies also use measurements, but they appear to make a more balanced assessment of the importance of the measurements in relation to other, less quantifiable factors of success (i.e., trust, satisfaction, teamwork, goal orientation, etc.). In such companies, success is measured in qualitative as well as quantitative ways.

Although measurements are important, they have some limitations. Measurements can become ends in themselves. Another common pitfall is the tendency to overmeasure. The infatuation with academic analytical techniques, the advent and proliferation of computer technology, and management's traditional desire to control has led many companies to overemphasize measurements. Some companies have gotten so bogged down in analysis and measurements that they have made little progress with their productivity and quality efforts. Too much stress on measurements has also been a cause of worker mistrust and alienation because in the past management has too often used measurements to control and punish people. In addition to these problems, Type I companies further limit their success by overemphasizing harder measures to the exclusion of more qualitative measurement factors. They would do well to examine the range of measurements, the question of ownership of measures, and the related informal reward systems used in some of the so-called excellent companies.

Methodology

The word "program" is very much a part of the everyday language in the methodology of Type I implementations. Programs are associated with starting and terminating dates. Managers chosen as program implementers are usually expected to outline or develop a workable program, and then bring it to a successful conclusion. Due to the discrete nature of programs, there are sometimes a number of independent programs existing separately and without coordination. One department might be rearranging machinery while another is launching quality circles; one manager might be cracking down on absenteeism and abuse of lunch time while another is introducing an incentive program. The rationale given for this multiprogram approach is typically that programs need to be "customized" to fit specific needs. Little thought is given to organizational readiness, effective implementation sequencing, and designing horizontal and vertical linkages among programs.

> *Type I organizations tend to have a limited understanding of what broad-based change requires.*

The programmatic approach of Type I companies is often used because it is comfortable for managers who prefer to perpetuate traditional forms of relationships and work structures. But it is not surprising that when this programmatic response tendency is indulged, one hears about the frustration these managers feel regarding the insufficient progress of their efforts. While the majority of managers with productivity and quality improvement responsibility do view themselves as "change" managers, they most often end up being program managers who fail to use a strategic change management process. Managers in Type I companies say that they want to instill productivity and quality improvement in the organization as "values," and there is some appreciation of the need to integrate improvement into the management system. However, the programmatic efforts are limiting because values are cultural variables, which those efforts ignore. The programmatic view of the management system is too limited, including only the rational or visible systems of planning, directing, operating, and controlling. It fails to direct energy to changing the nonrational and invisible systems (e.g., climate, culture, values, beliefs, norms, management philosophies and practices, etc.).

Although I have found no definitive study of current implementation methodology, the informal information strongly indicates that in only a small number of cases does one find the application of organization systems theory and strategic change management to improvement effort. The few organizations leading the way are Type III companies which have learned that organizational effectiveness rests upon the degree to which an organization systematically realigns its subsystems (social, technical, and administrative) to adequately meet strategic shifts. They are moving toward a more collaborative framework that emphasizes greater spontaneity in management action through teams, growing attention to organizational cultures, and a broader, more inclusive strategic planning process.

Type I companies do go through a subsystem realignment process, but it is an unconscious and haphazard process brought about through a trial-and-error, reactive approach of implementing productivity and quality programs unconnected to any long-term strategic direction; on the other hand, Type III companies are engaged in managing a defined transition in an explicit, deliberate, and proactive manner

Responsibilities and leadership

The degree of active top leadership support and involvement increases from Type I to Type III companies. A fairly typical scenario in Type I companies is the declaration of the need for productivity and quality improvements by edict of the CEO or president, with the task of achieving improvement frequently delegated to a staff person or, in some instances, to a specially created productivity "czar." In Type III companies, too, the CEO may unilaterally declare the need for some change or improvement, but he or she also shows a genuine long-term interest and a relatively high sensitivity to the impact of top leadership style on the culture, and takes an active role to lessen resistance to the instilling of new values into the culture. This personal and active involvement results in higher levels of management acceptance and ownership for success

The view that a company takes of leadership role and responsibility can enhance or limit success. In Type I companies, top leadership has a limited view of its role and responsibility in the total improvement process. It typically pronounces its organizational support and then appoints a line manager with only an operations or technical background to direct the process. These managers then approach their task asking the question, "What programs should I implement?" when they should be asking, "What changes do I need to manage?" After all, top management hasn't created and supported such new managerial roles because they wanted "programs" implemented. While on the surface it may appear that the mandate is to start a productivity or quality program, the real desire is less program specific: it is to see a change in the existing productivity and quality levels. The responsibility of these managers should be that of implementing and managing change, not programs. Top management frequently fails to see the need for their intimate, active involvement in this responsibility, which is one that cannot be so completely delegated to anyone else as described above

But the problem in Type I organizations is not just the failure of top management to see that it must be actively involved in broad-based change. In addition, it tends to have a limited understanding of what broad-based change requires. It is prone to perceive change only in terms of what workers must do—adapting to the organization's needs, working harder, and perhaps

showing more support for the goals set by management. Managements using the Type III approach recognize the mutuality of responsibilities in the management-worker relationship, and therefore realize that the organization itself may have to change fundamentally in order to achieve the desired productivity and quality gains. In both cases, management sees the need for broad-based change, but the view of what needs to change typically differs.

A major obstacle to strategic change within Type I and Type II companies is the attitude of the middle management group and the prevailing system of political dynamics. Most middle managers are fearful of beginning a productivity improvement effort on their own because of the possible imbalance it may create in the existing political system. Although the main role of the productivity manager is supposed to be that of an "integrator," helping top and middle management to develop a plan for integrating productivity improvement into the corporate strategy, culture, and systems, all too frequently the role becomes that of a "program implementer" who ends up spending considerable energy just trying to overcome middle management resistance while attempting to position program ownership in the laps of line managers. Again, top management involvement is needed if a programmatic focus is to be avoided.

encouraged, and authority and responsibility points are appropriately positioned for team decisions.

Although the two absolute essentials for productivity and quality improvement are change and employee involvement, Type I companies limit their own success because their philosophy of employee involvement limits the process. For example, in quality-circle or employee participation group programs, benefits are lost because involvement is voluntary. People who could contribute, but who don't volunteer for one reason or another, have little or no input into the improvements. Managers frequently believe that such programs are fine for rank-and-file workers yet have little applicability in management ranks.

Productivity and quality cannot be raised substantially without involving everyone in the organization in as many ways as possible. All key managers who control resources should be involved in guiding the transition to a more productive organization. Managers and supervisors need to be actively involved in the design of implementation tactics and cross-coordinated departmental activities. All employees should not only be actively involved in solving problems but should also accept decision-making responsibility and a level of accountability previously shouldered only by supervisors. The degree of involvement relates directly to the level of long-term success, measured strategically.

Degree of employee involvement

A universal feature of productivity and quality improvement efforts is the use of employee involvement, for the general belief is that productivity cannot be raised nor quality improved without involving employees.

The amount of organizationwide employee involvement increases from Type I to Type III companies. Limitations on involvement are inherent in Type I organizations because they implement programs while leaving work and social systems, values and culture, untouched. In addition, while efforts are made to involve employees, this involvement process is often not extended into management ranks. In Type III companies, opportunities for team involvement appear to be greater at all levels of the organization, teamwork is a more valued norm, participative management is consciously

Strategic focus

Although some degree of strategic planning is generally used by companies across the chart, two key dimensions of the strategic process change as one moves from Type I to Type III implementations. The first is the *time* focus of the process and the second is the *inclusiveness* of the process. Type I companies appear to be using a strategic process developed in the 1970s, whose coverage tends to be restricted primarily to technical areas and that has a three- to five-year time span. Type III companies tend to use a broader-based and more contemporary process that to a much greater degree includes and integrates horizontal functions (i.e., R&D, marketing, operations, finance, human resources, etc.) within a context of a total organizational framework (i.e., a systems approach including social, operational, and administrative systems), and

has a time frame of five years and beyond. In Type III companies, strategic human-resource management is a very important binder element serving to link the various organizational pieces.

Program versus strategic change

The failure to adopt a strategic change management process will limit the success of any improvement effort The programmatic energy expended by Type I companies is aimed at raising certain productivity and quality measures in the short term, not at designing a *system* within which such improvements will flow as a planned and long-term consequence of the system. So long as productivity and quality improvements are just another company program, lacking a long-term strategy, without a defined view of a specific organizational future, and not incorporated into the business strategy, there will be inherent limits to both its potential for short-term gains and its long-term viability.

What needs to be done better?

If long-term durability of productivity and quality gains are desirable, then what changes need to be made in how such efforts are implemented? Although there is no one universally accepted implementation approach, two fairly typical models are summarized in Table 2. While these models are certainly sound and valid, there are nevertheless at least two significant problems associated with them. The first of the two discussed below stems from management's failure to implement the models properly, while the second is inherent in the models themselves.

1. *Diagnostic neglect*. Although both models as well as others I have seen strongly encourage a diagnostic assessment, too many companies are ignoring this fundamental advice. In a speech delivered at the Annual Industrial Engineering Conference and Exposition in Louisville, Kentucky on May 25, 1983, Bill Ginnodo, associate director of the American Productiv-

Table 2
Productivity and Quality Improvement Implementation Models

Operations Model*	Organization Development Model**
1. Assess: Find out where you stand and what needs to be done	1. Awareness of needs. Brings productivity improvement problems to the attention of top management; is based on actual conditions in the operating facility
2. Organize. Decide what's going to be done, by whom, by what time, etc. This includes deciding what tools and techniques are most appropriate.	2. Entry of the specialist. Builds an agreement between management and the human-resources development specialist to focus on particular problems
3. Raise awareness. Consider also doing this before and after assessment	3. Diagnosis. Entails collecting and analyzing data
4. Implement change	4. Problems identified. Analyzed data is presented to management
5. Evaluation and reinforcement. Do this to determine what has changed, whether further action is needed, and who should be recognized for their accomplishments	5. Action plans. Involves taking the leap from problem to possible solutions. The specialist provides information, ideas, and resources
	6. Implementation and improvements. Requires problem-solving sessions and the support and commitment of management

*Based on a speech delivered by Bill Ginnodo at the Annual Industrial Engineering Conference and Exposition in Louisville, Kentucky on May 25, 1983
**Based on Eric L. Herzog "Improving Productivity Via Organization Development." *Training and Development Journal* 34(4) 36–39 April 1980

The vast majority of diagnostic instruments tend to be content focused and thus unsuitable for broad-based assessments.

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ity Management Association, commented on this problem:

> . . . the human resources director of one of the country's biggest users of quality circles recently told me: "employees and managers learn a lot about participation from circles but I'm convinced we shouldn't have gone that way. I wish we had spent more time up front, studying our needs and developing a fuller program. I'm sure we would have done things differently " . . . During a break in one of the APMA's national meetings, I approached the group that had surrounded the last speaker—a productivity manager from a pharmaceutical firm—and heard someone ask him, "If you could begin your program all over again, what would you do differently?" Without hesitating, the speaker said, "I'd do a more complete assessment. We missed the mark in quite a few areas."

Even if a productivity manager decided to do a diagnosis, another difficulty is finding a diagnostic instrument that has broad-based systems scope and that can be readily interpreted so as to be of practical use to operating people. While there are a number of instruments available, the vast majority tend to be somewhat content focused and thus unsuitable for broad-based assessments. However, for assessing the social and managerial system, the Survey-Guided Development Process developed by the Institute for Social Research at the University of Michigan is one of the best surveys available. In order to assess the productivity of the operating system itself, the Industrial Productivity Institute has developed what is called the Team Productivity System survey. In combination, these two assessments are a powerful assessment package.[1]

2. *Lack of orientation to a strategic change management process.* For there to be productivity and quality improvement, carefully managed strategic change is required. Unfortunately, the models summarized in Table 2 have a programmatic connotation. For example, regarding stage 1 in the OD model, Eric Herzog states:

> . . . the organization and human resource specialist can assist top management in developing

any number of programs to heighten awareness in the existing manufacturing facility to the need for improved productivity. These types of programs may include: (1) Absenteeism . . . (2) Cost-reduction . . . (3) Improved identification with product and company . . . (4) Improved training . . . etc.

Note that the organization will have already established the norm of applying programmatic solutions even before the problems have been diagnosed. The models do mention "change," yet fail to spell out in detail the techniques of even a simple change management process. While the models' basic steps help managers get started, improvement efforts frequently lose steam and focus because of this lack of greater specificity in the models. Some companies following a Type III implementation have recognized this weakness and have spent more time conceptualizing the stages and phases of change before taking action, thus keeping their improvement efforts clearly focused and directed. The result was described by Bill Ginnodo in the aforementioned May 1983 speech at the Annual Industrial Engineering Conference and Exposition: "We've been impressed by the fact that some of our APMA member companies have 'planned' their way through these stages, rather than work through them by trial-and-error."

Even where managers recognize the need for such change, these models limit their view of what needs to be changed. For example, change programs may be too narrowly focused on altering only employee attitudes or in just solving certain types of technical operating problems. Management usually fails to see or appreciate the extent and depth of changes that need to be made. One reason for this is that in school, managers have been taught "linear" management models (concepts of planning, leading, organizing, controlling) such as those under discussion here; i.e., they are taught to manage organizations as rational entities. Therefore, they encounter problems when they try to instill *values* of productivity and quality into the visible and linear management system. Values are not a part of such a system but are rather part of the invisible and nonlinear system called culture. Culture cannot be changed through the programmatic process suggested by the models currently in use.

If the projections of continued high rates of

technology change hold true through the 1990s, the degree of environmental turbulence that they foretell will require a more complete strategic planning process than was developed in the 1970s. A comprehensive, long-term horizontally and vertically linked strategy needs to be developed. A company's productivity and quality strategy will have to cover the entire organization with all its systems and procedures, and will need to be incorporated into the overall business strategy. Long-term improvements will not be accomplished without permanent changes in the level of employee involvement; without changes in the points of authority, responsibility, and decision making; without changes in management philosophies, styles, and relationships; and without changes in climate and culture. But a broad strategic approach is not even mentioned in either of the models, although it is the only real hope for achieving lasting gains.

A direction for change

The idea of developing a strategic approach to organization productivity and quality improvements ought to raise questions and concerns for the managers in Type 1 companies—and there are many such managers, because the Type 1 implementation methodology represents the predominant approach being used by the Fortune 1000. Should all of the productivity and quality efforts already started in the context of this methodology be scrapped? How does a productivity manager approach changing the direction of the existing effort?

Existing efforts need not be scrapped. But the focus of energy, attention, and work needs to be consciously and systematically shifted.

It is essential to move from a programmatic to a strategic change approach. The first step in doing so is identifying the critical group of people in the organization that controls resources. The support and involvement of that group is essential if any substantial and strategic change is to occur.

With that support, the organization must proceed to redesign its culture. Cultures are very difficult to change, given the systemic resistances (political,
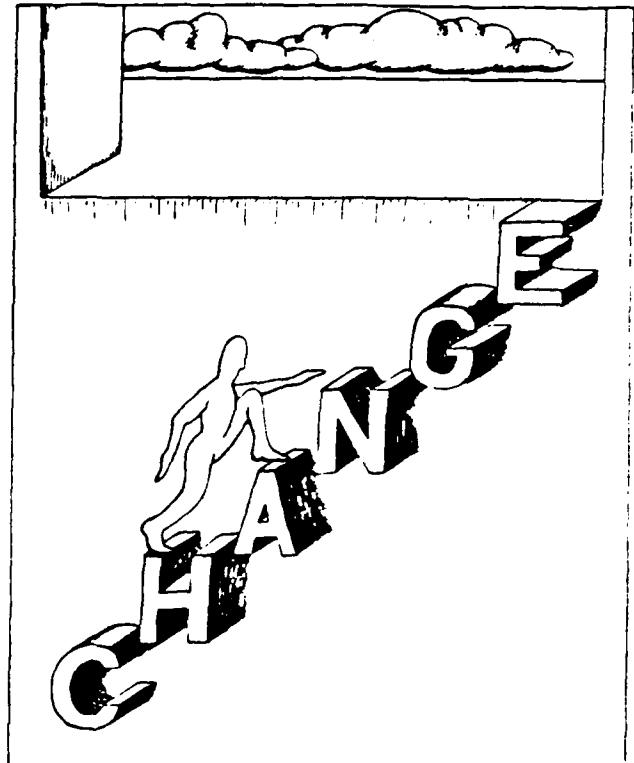
social, structural, etc.) that exist. Rather than approach a culture change directly, the productivity manager should get key managers actively involved in building a vision of what the company wants and needs to be (i.e., defining a future state where the desired productivity and quality goals are being achieved) before confronting the reality of what the company is actually like today. This approach will serve to reduce resistance to change, build participative management ownership, develop support for moving toward a defined future, gain visibility and agreement for the need to change the organization fundamentally and substantially, and help managers begin to understand the strategic impact of cause and effect relationships in the organization's systems.

Four key steps to planning and organizing a redesign are:

1. *Definition of a philosophy.* Every organization has a climate and culture and operates according to some set of philosophical principles, whether stated or

not. As part of defining the desired organizational future, involve managers in developing a statement of what the company's philosophy should be.

2. *Definition of goals and values.* Organization goals need to be clearly stated and communicated to everyone Peter Vaill calls this "purposing," which he defines as "that continuous stream of actions by an organization's formal leadership which have the effect of inducing clarity, consensus, and commitment regarding the organization's basic purpose."[3] In addition to goals, managers need to define and explicitly state the values the organization should foster in the desired future state. In their *In Search of Excellence,* Thomas J Peters and Robert H Waterman state the following regarding the importance of values:

> . . . let us suppose that you were asked for one all-purpose bit of advice for management, one truth that we were able to distill from the excellent companies' research We might be tempted to reply, figure out your value system, decide what your company stands for . . . put yourself out ten or twenty years in the future

3. *Organization of a transition steering committee.* Many of the people appointed to coordinate or manage a productivity or quality improvement effort end up being the focal point of the effort, with management expecting them to develop (usually on their own) a workable program and to successfully facilitate the implementation of that program. The formation of a management steering committee as a planning and decision-making body not only builds management ownership for success but can also serve the function of the parallel structure needed to manage the transition between the present and the future state. Where a steering committee already exists, its work should be expanded to include future state definition in addition to current programmatic considerations.

4. *Development of the strategic change plan.* The plan to improve productivity and quality should be developed by the steering committee, with the participation and involvement of other managers. This plan should encompass all the major systems: people, structure, technology, administrative policies and pro-

cedures, and culture. When completed, this plan becomes a focused business strategy explicitly aligned with other business strategies, a systems-based approach linking specifically targeted efforts into a consistent and coordinated whole. The key to managing the transition to a highly productivity- and quality-conscious organization is the alignment of all of the organization's key components—its mission and strategy, its structure, and its human resources—within the operating, administrative, social, political, and cultural systems; and to align each of these systems with the others When done properly, the organization will have managed a strategic redesign to a cultural system where high productivity and quality are a way of life

Defining the future state

I will conclude by presenting some of the characteristics of organizations in their desired future state: i.e., after they have adopted an integrated strategic approach to productivity and quality improvement.

The definition of the desired future state of the organization should be an extended, wide-angle "photograph" of what the organization would look like in its new state. This definition should explicitly include such areas as:

- Philosophy, mission, and values,
- Expected organization structure;
- Reward system;
- Personnel policies;
- Authority and task/responsibility distributions;
- Managerial styles;
- Performance review systems; and
- Performance outcomes.

If we were to do some crystal ball gazing to identify a few of the more significant future state characteristics expected in firms that have enduring and significant productivity and quality gains, what might we find? Looking at some of the firms that have already designed such organizations, we find such characteristics as the following:

*The organization should make a specific
commitment to provide job security at all levels.*

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1. An ongoing, data-based diagnostic process serves as a feedback mechanism providing periodic systemic "snapshots" of the evolving organization. This diagnostic process is complementary to existing traditional measurements.

2. Strategic human-resource planning is closely linked to business planning. This helps to level work loading and minimize work-force fluctuations due to layoffs. Stable work environments are needed to foster the values of involvement and teamwork.

3. Management participation includes everyone, in some way, from the CEO down through the supervisory ranks. Should a key decision maker leave, the process will continue because the goals are commonly known, the ownership is shared, and the values are deeply ingrained into the culture.

4. Where a union exists, the fundamental philosophy of management toward it is one that values trust, open sharing of information, mutual support and cooperation, and joint participation in all decisions.

5. Managers have the skills to manage a changing and evolving organization, not static entities. Decisions are more decentralized and happen faster. Managing high productivity and high quality systems is an ongoing process, not time limited by a programmatic schedule with a beginning and end.

6. Organization goals are formally stated, written, and known to everyone. The goals are specific, clear, and apply to all, with defined rewards for both management and employees for achievement.

7. The values of productivity and quality cover more than just product or service. These values are shared by all, regardless of job, level, or function. They are diffused and pervasive, affecting daily work habits and working relationships.

8. Training (job, technical, and management skills) is a vital part of the culture. There is ample opportunity for and encouragement of growth, development, and renewal.

9. Because human resources are recognized as the most valuable resource any organization has, the organization has made a specific commitment to provide job security to people at all levels, assuring that no employee will lose his or her job because of improvements in productivity and quality.

10. Performance goals are set mutually by management and workers, with points of responsibility and accountability pushed down to the lowest possible level.

11. Management will operate more clearly in accordance with explicit values and a socially responsive ethical framework. Its style will be characterized by participation, entrepreneurship, human-resources primacy, and proactive management of the organizational response to the increasingly uncertain technical developments of the coming decade.

Conclusion

Managing change is always time-consuming and never easy, and it requires long-term management dedication. But in order to achieve the type of long-term high levels of productivity and quality needed if U.S. firms are to be internationally competitive, managers must put aside outmoded organizational structures and practices. To assure competitive futures for their organizations, they must also go beyond timid experimentation with programs in a trial-and-error fashion. A strategic approach to managing change offers the only real hope. Fortunately, some organizations have already pioneered this road of discovery.

NOTES

1. For further information on the Survey-Guided Development Process, contact: Organizational Development Research Program, Institute for Social Research, P.O. Box 1248, Ann Arbor, Michigan 48106 (Phone: 313-764-6108). For further information on the Team Productivity System, contact: The Industrial Productivity Institute, 1521 Chicksaw Drive, Naperville, Illinois 60540 (Phone 312-420-7092).

2. Eric L. Herzog, "Improving Productivity Via Organization Development," *Training and Development Journal* 34(4).38, April 1980

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RESOURCES

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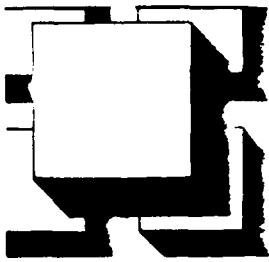
2-2

Beginning the Quality Transformation, Part I

Peter R. Scholtes and Heero Hacquebord

Beginning the Quality Transformation, Part I

Practical
strategies and
guidelines to
help managers
plan for and
carry out a
quality
transformation

by
Peter R. Scholtes
and
Heero Hacquebord

WHEN W. EDWARDS DEMing describes an organization committed to quality, he provides a compelling picture of how things ought to be. But there are precious few instructions on how to begin such a transformation. However, there are some practical elements involved in becoming a quality organization. The approach must be based on the pragmatic realities of business life: that change is difficult; that resistance to change is often strong and persistent; that no matter how much a company might want to transform itself to some new order, it must continue doing business and, for the time being, do so in the way it knows best. Transformation, therefore, involves a sort of adolescence—a period of inelegance when we shift from one way of being to a new way of being.


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Guidelines for quality [1]

1. Quality begins with delighting the customers. [2] A company should strive to delight customers, giving them even more than they imagined possible. Management may be ecstatic, the board of directors blissful, and the company may be considered a legend on Wall Street. But if your customers are not delighted, you have not begun to achieve quality.

2. The quality organization must learn how to listen to customers and help customers identify and articulate their needs. If quality is to be defined by the customer, the quality organization must remain close to the customer. Closeness means much more than surveys and interviews. It means knowing in detail the work the customer does, how the customer uses your products, and what concerns and problems the customer has. Be aware not only of problems resulting directly from defects in the product, but also of related problems experienced by customers even when the product is functioning properly.

Those who are not yet your customers can also provide you invaluable feedback on your product or service. Why don't they use the product? What do they use and what has been their experience with it?
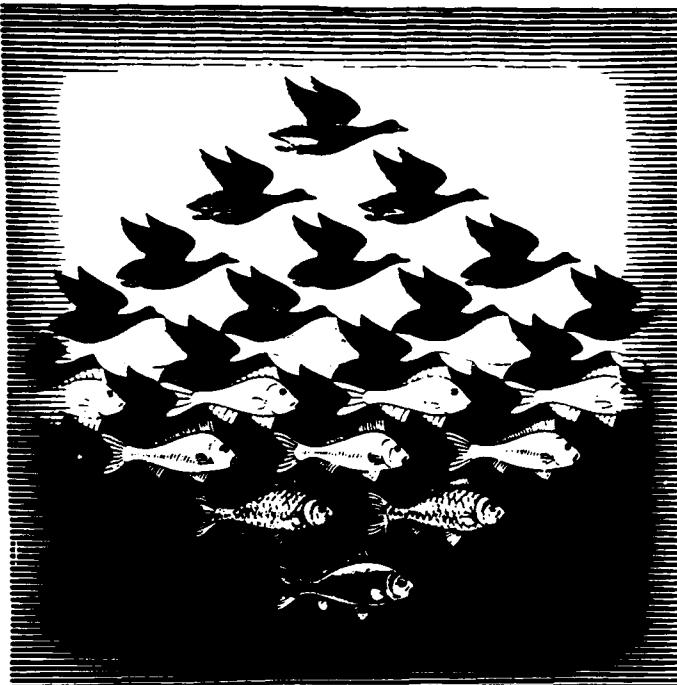
3. The quality organization leads customers into the future. [3] We depend today on photocopiers, personal computers, disposable diapers, and other products that, in the past, we didn't even imagine possible. A quality organization knows the consumers so well, and explores technological possibilities so far, that it leads everyone into products and services not yet imagined.

4. Flawless, customer-pleasing products and services result from well-planned systems and processes that function flawlessly. [4] Inspection may be a way to avoid embarrassment, but it is not a way to achieve quality. A flawless system provides what the customer wants, when the customer wants it, with efficiency, precision, and consistency—and without waste, defects, or rework. A quality system is continuously being improved.

5. In a quality organization, the vision, values, systems, and processes must be consistent with, and

complementary to, each other.[5] The vision answers the question, "What businesses are we in?" Values or operating policies describe "how we conduct our business."[6] Systems and processes are the sequences of activities by which all work gets done. When these work at cross purposes, the result is waste and frustration: engineers design a product that production can't make; purchasing buys materials that production can't use; sales makes promises that can't be kept. Each step of a process must be the perfect antecedent to the next step.

6. *Everyone in the quality organization—managers, supervisors, and operators—must work in concert.* A spirit of teamwork must pervade the organization. This spirit must be strong and pervasive enough to supersede the attachments that people normally form to bonds such as profession, function, or rank.

7. *Teamwork in a quality organization must be based on commitment to the customers and to constant improvement.* Teamwork is used in two ways in the quality organization. First, it refers to a spirit of loyalty and collegiality throughout the organization. Second, it refers to the greater use of teams and participative processes in the conduct of business. In neither case is teamwork a product of pep talks and exhortation. Nor is it blind loyalty. Nor is it merely feeling good. Teamwork results from a common understanding of the organization's vision and values, a dedication to delighting customers, an understanding of the organization's systems and processes, and a shared commitment to the ongoing improvement of those systems and processes.

8. *In a quality organization, everyone must know his or her job.* A job is not learned simply by reading a job description or operations manual. Employees must:
- understand where their work fits into the various larger systems and processes of which they are a part; what and who precede them and follow them in the sequence of activities; and how their work relates to the final product and ultimate user or consumer.
- know what their internal customers want and don't want, and what would delight these customers.
- master the information and skills necessary to perform tasks related to their work; constantly renew and upgrade knowledge and skills.
- understand the process or technology with which they work: how it functions, its capabilities, and what causes variation and breakdown. They must constantly get to know it better and learn how to improve its performance.

This level of understanding requires both continuous education and regular feedback from each employee's external and internal customers

9. *The quality organization uses data and a scientific approach to plan work, solve problems, make decisions, and pursue improvements.*[8] Managers help everyone focus on the method by which the organization's work is accomplished. All types of initiatives and activities are monitored to see how well they are working and how they can be further improved.

10. *The quality organization develops a working partnership with suppliers.*[9] The quality-minded company exercises great care over the materials and services it receives. The quality organization seeks a long-term collaborative relationship with a single source for each type of supply.

11. *The culture of the quality organization supports and nourishes the improvement efforts of every group and individual in the company.*[10] The organization seeks to establish and maintain a spirit based on being close to the customer, the importance of precision and data, internal teamwork and mutual respect, constant improvement, and pride of work (both processes and products)

The new concept of the organization[11]

The old way to view an organization is known as the chain of command (see Figure 1). This view of an organization was developed in the 1840s, when businesses for the first time needed to manage mass production, wide distribution, and geographically dispersed organizations.[12] This view has some shortcomings. It doesn't portray the interdependence of functional areas. It doesn't describe the organization as a flow of processes. It tends to emphasize individual accountability rather than the group, the process, or the output of the group and process. There is no reference to products or customers in this view. Therefore, the purpose of the organization, implied in this chart, is accountability and control. All paths lead to or from the figure at the top

The new way to view the organization is shown in Figure 2. This diagram was first used by W. Edwards Deming in Japan in 1950. It depicts:
- the interdependency of organizational processes.
- the primacy of the customer (consumer).
- the effect of customer feedback (consumer research)
- the need for continuous improvement based on customer feedback.
- the importance of suppliers.
- the network of internal supplier/customer relationships.

Figures 1 and 2 symbolize different ways of thinking and a difference in priorities. If you ask someone, "In your work, who is it important for you to please?" and if he or she answers "my boss," that person experiences the organization as a chain of command. If the answer is, "The people in the next step of the process, my internal customer, and our external customer," that person has a systems perspective.

Figure 3 offers a different illustration of this new concept. Various functional units must work in concert with each other. The quality organization has no appetite for turf wars or intramural one-upmanship.

It is necessary to have a systems view of the organization to become a leader or member of a quality organization.[13] A leader who views the organization as a chain of command and accountability will not be able to visualize the company as customer- and quality-oriented, and thus impedes the pursuit of quality

Guidelines for transformation[14]

Ordinarily people in organizations will not simply convert from an old way to a new way, even when the new way is demonstrably better.[15] Change also takes more than an authoritarian edict "Beginning next Monday we will practice quality management—or else!"

To some extent, this and the following section were written with small- and medium-sized companies in mind. In a corporation with hundreds of thousands of employees dispersed around the world, these initiatives will seem geared to a scale that is hopelessly small. However, two points are worth comment

First, a huge corporation is, in many respects, a vast multiplicity of smaller organizations. The guidelines described here can be applied to the corporate headquarters as one organization and to each successive cluster of organizational units. With a steady, gradual process of transformation, it is easier to develop the corporation's human resources into a commonwealth of support for quality transformation. We are leery of the impatience of some managers who try to force growth when it should be nourished

Second, the goals of transformation must be consistent throughout the corporation. There should also be some consistency in the method and means used to achieve those goals. Can such consistency be achieved in a huge corporation without some kind

Figure 1. The old way to view an organization: the chain of command.

Top
Management

Middle
Management

Lower
Management

Foreman,
Supervisors,
and so forth
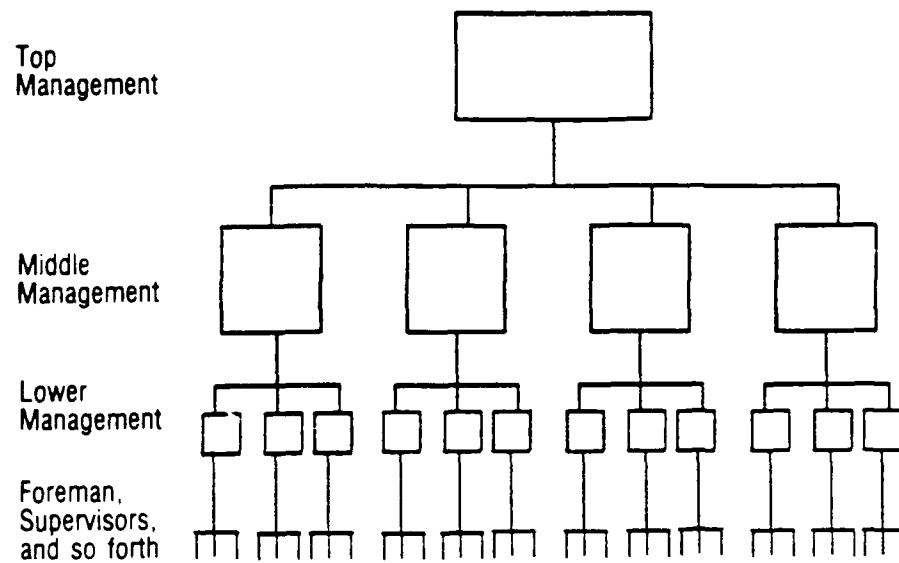
An 1840s innovation for companies: the basic hierarchical structure of business enterprise.

From *The Visible Hand*, Alfred D Chandler Jr (1977)

Figure 2. The new way to view an organization: the system.

Suppliers

A
B
C
D
E
F
G

Design
and
Redesign

Consumer
Research

Distribution

Consumers
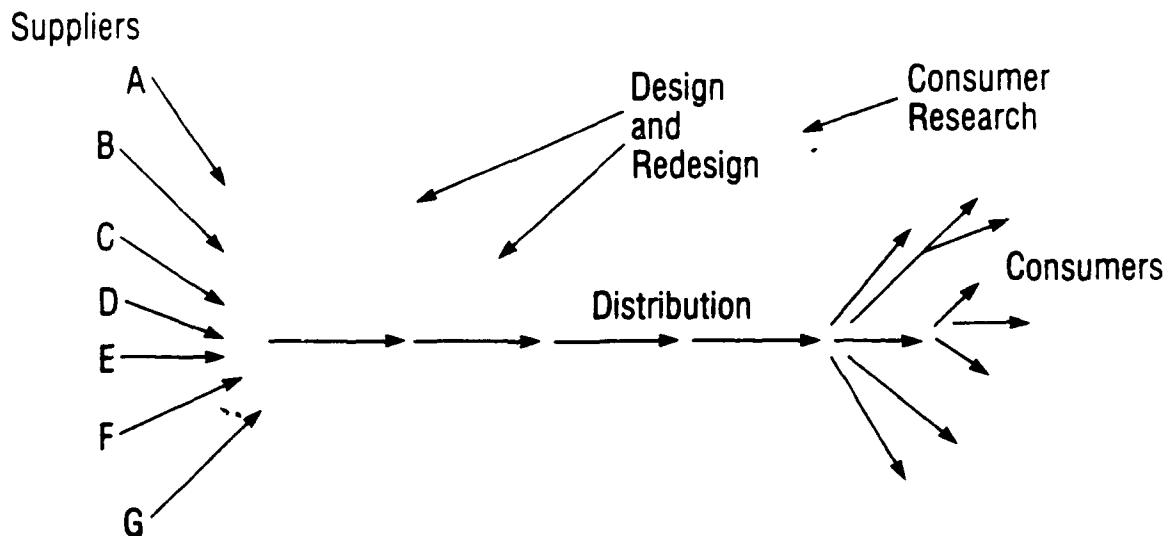
Figure 3. The new concept from the perspective of functional divisions and sections.
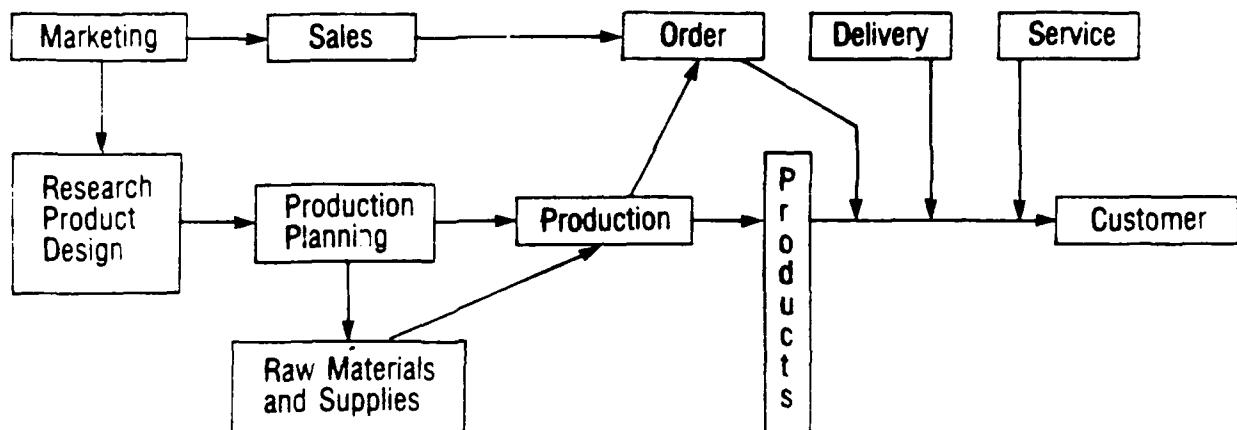
of coercion? Probably not. But what is prescribed should be kept to a minimum. Moreover, the need for whatever is prescribed should be explained in some detail. Whenever possible, what is prescribed should be a process rather than the end result. Finally, when the leaders of an organization announce a change to which they expect everyone to conform, they themselves must undergo change. Their change must be a clear demonstration to everyone of the importance of this transformation.

Guidelines for change

Recognize the informal organization.[16] Think of a company as a small town or a large high school. Along with its official work system, the organization is also a social system—a loose network of small groups of people. These groups offer their members support and friendship. People in these groups can form a strong bond of loyalty to each other, which in many cases is greater than their loyalty to the company. These informal groups have leaders. Often, these groups have rules that can determine, for example, the pace of work, what kind of contact or communication with managers is okay, etc. If the informal organization and the informal leaders accept whatever change is being proposed, that change will occur much more smoothly. If they oppose the change, it may be nearly impossible to implement. Therefore, it is important to identify the informal leaders, get to know them, and spend time wooing them.

Seek the active support of a critical mass.[17] In the context of organizational change, a critical mass is a dynamic and somewhat elusive quantity. It is not simply a majority. What constitutes a critical mass at one stage of innovation may be inadequate in later stages. Critical mass is a sufficient number of influential people supporting a proposed change to give the impression of a growing, formidable movement, a sense of momentum, a groundswell of interest. Critical mass describes the constituency

behind a proposed change and the ability of that constituency to attract more and more support as time goes by. Critical mass may be defined laterally in an organization (e.g., a sufficient number of champions among division managers) or vertically (a sufficient number of committed people in division X). Because of a changeover of people and the ongoing nature of a change, an ultimate critical mass may be hard to achieve.

When managers and others in a typical organization are presented with major changes, their response will fall into some variation of the bell-shaped curve. Some will support the change, some will resist it, most will be undecided and wait. The same thing applies to the movers and shakers who are present in every organization. These are those people who—for whatever reason—are influential. They usually, but not always, have positions of authority. Even within the ranks of management there are those who are more influential than others. With their support, a proposed change will probably have a good opportunity to prove itself. Without their support—worse yet, in the face of their resistance—a proposed change has little chance of success.

A critical mass in the earlier stages of change consists of an ever-increasing number of movers and shakers shifting from being neutral to being supportive or shifting from resistance to neutrality. Those who are promoting the change would do well to spend most of their time wooing the neutrals, even though there may be more personal satisfaction talking to the believers and supporters. It is also important to get resisters to at least withhold judgment.[18]

People don't resist change, they resist being changed.[19] Transformation is a campaign for people's hearts as well as their minds. A change is successful because a critical mass has rallied around the proposed change. Creating such a loyal constituency is not ordinarily an undertaking permeated with logic. Nor can it be created through fear.

The Onion Patch Strategy

What can be done when your company's top managers are not quality leaders and champions? When you are a lone quality champion without the support of top leadership—a "lonely little petunia in an onion patch"?[23] In general, the onion patch strategy is: "Think big, but stay close to your roots." Select improvement efforts within your span of control—but select improvements that capture the attention of people at least two links up in the chain of command. Look for projects with "big dollar" implications. For example, projects that reduce waste or rework, or increase sales or revenue. Concentrate your efforts on achieving the kind of results that the others, even the skeptics, will respect. Include other people in your efforts. Include even more people in the sharing of credit for a successful job. Build a network of believers and supporters while you make real improvements in the system.

Sometimes you will have direct supervisory responsibility over people involved in improvement efforts. If so, shield them from outside pressures so that they can continue the work of improving quality.

Be patient and persistent. If you succeed you may create opportunities to introduce the wider implications of quality to higher and higher levels of the organization. Meanwhile, prepare for any opportunities. Be ready to pounce when a mover and shaker asks for information or suggestions. Have at hand copies of books, articles, or videotapes of various lengths that are suitable introductory materials for your managers.[24]

Have prepared an introductory presentation that is flexible enough to fit time slots ranging from 15 to 90 minutes. Have your presentation rehearsed and ready to go. Include, among your presenters, hourly operators who have become zealots for the new way. They need not be slick or articulate. Their excitement will be eloquence enough.

Identify the most common questions or objections and be prepared to respond to them. Figure out ways to persuade your managers to hear the quality leaders speak. Compile success stories. Prepare them in a "picture book" format that is easy to follow and loaded with graphics. Ask the resisters to help out on some quality activity.

The onion patch transformer must keep in mind that his or her efforts should always be geared to getting the attention of top management, educating them, and making believers and champions of them. Without their eventual buy-in, all of your transformation efforts will wither on the vine.

Change by edict and coercion has many inadequacies. Top-down orders can get ignored, sabotaged, or dissembled in a thousand ways. In an authoritarian organization, much of the creativity goes into designing ways to circumvent authority. Furthermore, coercive methods of introducing change reinforce the chain-of-command concept of the organization. The implicit message to the organization is, "All ye who enter, take off your brains and put on fear." You will need creative, thinking people in a quality organization. Don't coerce them into a change.

People need to feel included in the decision to change. At least they need to be presented with the rationale for change. Their needs, fears, desires, and concerns about the change deserve to be listened to, responded to, and accommodated whenever possible.

Sometimes change is uninvited and unavoidable. When all or part of the organization has change imposed on it, its people are likely to undergo some transitional stages similar to those experienced by people near death. Elizabeth Kubler-Ross has identified those stages as follows:[20]

- Denial: this crisis, too, shall pass away.
- Anger: why should I change? Let someone else change!
- Bargaining: can't we work out some compromise on this?
- Fear: I don't know if I can handle it. What will become of me?
- Resignation: okay, let's go ahead.

An organization's leaders should be sensitive to these stages of transition and help people through them. Active listening is a powerful method. Help them bury and mourn the past and then get on with the future.

When possible, organization change should be planned and treated like a courtship—with a mixture of gradualism and surprise. For example:

- When some facet of the change represents a very different way of behaving, allow people time to warm up to it and experiment with it. Give them time to be inelegant and make mistakes.
- Plan change in increments of gradually increased risk or adjustment. Help the organization stretch itself, but not too much at a time. A localized implementation of some innovation may be easier to undertake than a widespread implementation. Something approached as a temporary experiment may be more acceptable than a permanent change.
- Look for visible signs of the old order and replace them with symbols of the new order. A shift of symbols can help facilitate a shift of vision, policies, systems, and processes.
- Woo the undecided movers and shakers and the formal or informal leaders. Woo here means to spend time listening to them. This is time spent not exhorting them to support the change but listening to what concerns they have in general. Don't focus only on concerns related to the proposed change. Listen actively.[21] Learn if any of their needs might be addressed by the proposed change or if the change might be adjusted to accommodate their concerns.

Efforts to implement change should be "anchored." Anchoring means that individuals or groups directly involved in innovative activities should be surrounded by a network of others involved in similar activities. There must also be services that offer support and guidance to the innovators. Without such anchoring, the innovators will more likely feel isolated, as if they are floundering or inadequate. For example, imagine a project team assigned to study and improve a process. Rather than allowing it to function in isolation, have it report to a team of

managers who can support and advise the project team. This creates several levels of anchoring, i.e., reinforcement. The connection here is not to a single manager, but to a team of managers, each reinforcing the other and all of them reinforcing—and being reinforced by—the project team. Thus, several people are engaged in growth, change, and improvement and each supports the other in that effort.

The project team will need technical assistance, particularly in project planning, team management, and the scientific approach. Therefore, a technical adviser is assigned to coach the project team and the managers.

There are several advantages in having more than one task force or project team operating at a time. Project teams can learn from each other and share some training. Concurrent projects can also create challenge and mutual support. Each group is anchored to other groups through occasional contact and interaction.

With such a well-connected network of activity, those involved in implementing change will not feel isolated and floundering. They will feel part of a common effort of learning and change. Checks and assistance are available if a group should falter. Meanwhile, overall progress can be maintained.

The more profound, comprehensive, and widespread the proposed change, the more absolute is the need for deep understanding and active leadership by the top managers.[22] Leading the transformation cannot be delegated by the top manager. Without the active leadership of top managers, efforts at profound change may flourish for a while, but they will not last. Without the active leadership of top managers, many of those in the second echelon of leadership will wait for some indication of lasting direction. Thus the effort to change will have passive, shallow, tentative support. Such efforts will be displaced by other priorities and will be vulnerable to activities that contradict the goals of the proposed change.

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3. The authors are grateful to W. Edwards Deming for this addition to the guidelines for quality.

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21. An excellent resource for active listening is Thomas Gordon. *Leader Effectiveness Training* (New York: Bantam, 1980), pp. 55-74.

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24. Tribus is an excellent source for this purpose. The MIT Center for Advanced Engineering Study has published several excellent papers by Tribus.

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Coming in August: Part II of this two-part article will discuss the initiatives and activities for translating basic principles into a strategy for transformation.

2-3

Six Strategies for Beginning the Quality Transformation, Part II

Peter R. Scholtes and Heero Hacquebord

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Six Strategies for Beginning the Quality Transformation, Part II

It is the manner of the boll weevil, not the bulldozer, that best leads to change.

by
Peter R. Scholtes and Heero Hacquebord

L AST MONTH, SCHOLTES AND Hacquebord described basic guidelines for achieving quality and organizational change. In this issue, they explain ways to apply those guidelines to the process of achieving a quality transformation.[1]

1. Top managers learn to become leaders, exemplars, and teachers of quality.[2]

Top managers lead as individuals and as a group. As a group, they are the steering committee of the transformation. They plan and strategize. They select targets and priorities. They are instructors of and promoters for transformation.

As individuals, top managers:

• develop a noticeably different manner in working with their co-managers and direct reports. They seek to improve a system, instead of seeking someone to blame. They listen and try to mutually solve problems, giving fewer orders. They seek more data and analyses, depending less on fiat and guesswork. And they aren't as hurried, taking more time for precision and care.

• learn to see themselves as suppliers to a variety of internal customers whose needs and expectations they will learn to identify, meet, and exceed over and over again.

• become instructors in seminars and presentations to employees on the quality effort.

• continuously seek more resources on quality for their own education. They also recommend books, articles, seminars, videotapes, etc., to others to deepen their understanding of quality.

• continuously seek new ways to integrate the quality efforts into all existing corporate activities, such as planning, reviewing budgeting, marketing, and key reports and presentations.

• are increasingly inclined to ask for data when discussing work with others in the organization.

• identify symbols of a chain-of-command organization (parking facilities, eating facilities, dress codes, etc.) and change them to reflect a new outlook. Managers find various visible signs of a new way.
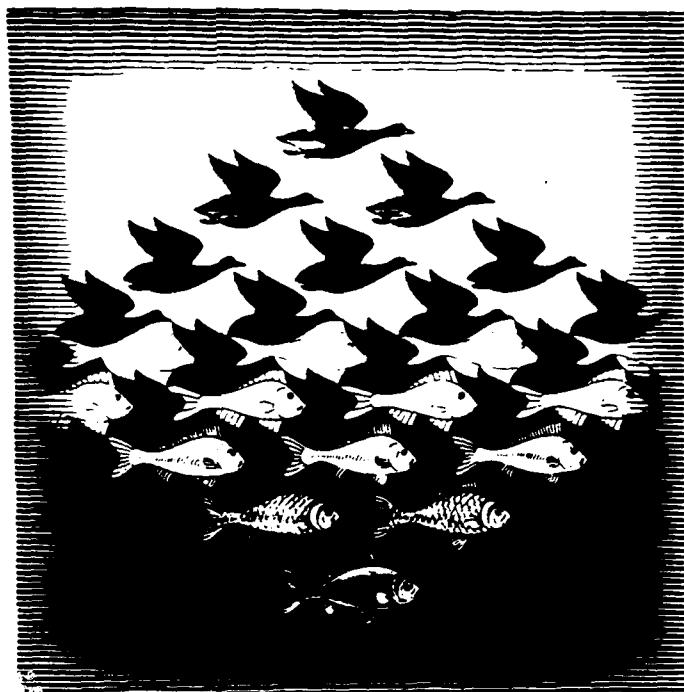
• spend some time listening to a variety of employees at every level. Managers learn about employees' concerns and observe, without judgment, what they do in their jobs. Managers must understand what is involved in the execution of their employees' work and what gets in the way of good work.

• actively listen to people's resistance to transformation, helping them to let go of the past and understand and accept the new way.

• meet with groups of employees, listen to their reactions and suggestions, and follow up immediately when possible.

• promote and are directly involved in creative ways to build bridges between employees and customers. Managers should bring customers to the employees and take employees to the customers.

• learn to practice quality audits.[3]

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2. Managers establish improvement projects that are carefully selected and guided by managers, conducted by cross-divisional teams using the scientific approach, and coached by technical advisers.[4]

Each phrase in this strategy statement is worth looking at closely.

Improvement project: A carefully planned and directed effort to achieve a major permanent breakthrough, resulting in a measurable betterment of a product, service, or process. The results may involve the solving of a problem, the reduction of costs or wasted material, reduction in required time, reduced errors and rework, less variation, etc.

Carefully selected: Because they are part of an introductory phase, these projects should be almost certain successes. They should ideally have the potential for high visibility or a big dollar payoff, or should involve a change that will affect customers directly and please them. The first projects should focus on very specific tangible improvements to a clearly limited and defined process (e.g., reduce late deliveries of product X or eliminate product spillage in the bagging operation).

Established by managers: To encourage managers to pay attention to early transformation activities, learn from them, and personally oversee them, the efforts must involve matters about which the managers have some genuine concern. Nevertheless, managers are encouraged to solicit project suggestions from the work force.

Guided by managers: The project teams engaged in the day-to-day conduct of this project meet regularly (approximately monthly) with a team of managers that is responsible for guiding the project. The managers are usually the same ones who established the project. The monthly meetings allow the managers to make suggestions, to support the project team, and to make those decisions that only they may be authorized to make. Managers also learn about a company process and what is involved in process improvement—and why lasting improvements cannot be rushed.

Conducted by cross-divisional project teams: The leader and members of the project team are appointed by the managers. The team's membership represents people whose jobs bring them in contact with the process under review. The team membership may cut across divisional lines whenever this is necessary for a representative team. Project teams may also draw from different levels of the hierarchy when that is suggested by the scope of the project. Ordinarily the project team should not exceed six members (not including technical advisers).

Using the scientific approach: A scientific approach to improvements is one based on reason, logic, analytical problem solving, and the use of data. This is an important part of the quality improvement effort. It is not enough for a project team simply to agree on some conclusion, for example, on the cause of a problem. They should also have carefully accumulated data to support that conclusion.

Coached by technical advisers: Technical advisers provide assistance to the team in two basic areas: facilitation or organizational development skills (helping them plan their project, conduct good meetings, and develop themselves as a team) and engineering and statistics (to guide them in the scientific approach and help them gather and analyze data, and solve technical problems). Technical advisers attend each meeting of the project team and provide training to the team as needed.

The progress and final results of projects should be presented, since the projects are meant to educate and inspire as well as make improvements. The project team members should present their results to various groups of managers and employees. Each team member should participate.

One caution on improvement projects: project teams are so powerful and successful that they create a hazard. Managers can be seduced by projects into the belief that transformation consists of an endless succession of projects and teams. Projects are also attractive to some managers because projects don't demand much of them. A project should be viewed as an excellent improvement tool, a fine team-building mechanism, and a wonderful educational device. But projects are not transformation. By themselves, 10,000 successful projects will not transform the company into a quality organization or its managers into quality leaders.

3. Top managers engage in quality transformation planning starting with a two-year blueprint for preparation, start-up, and early expansion.[5]

This blueprint is important for what it encourages and also for what it implicitly discourages. It encourages a specific strategy. Thus, it discourages a haphazard, play-it-by-ear approach to implementing quality. It encourages that the planning be done by top management. Thus, it discourages delegation of planning efforts downward in the organization. It encourages looking ahead for two years. Thus, it discourages short-term commitment and a search for instant solutions. It encourages targeted efforts. Thus, it discourages an everywhere-at-once approach.

The two-year blueprint addresses such questions as:

1. What strategic issues should be considered in the selection of the first efforts? For example, should areas where there is high visibility be selected? Greater possibilities for major gains? Receptive key personnel? Critical need? Greater chances of success? Congruence with other corporate plans? Natural lead-ins to future expansion of the quality implementation effort?

2. Who will be the point person coordinating the implementation in the targeted area? How will he or she be prepared for the responsibility? What kind of ongoing development will he or she receive?

3. What preparation will the managers, supervisors, key staff people, and union representatives in targeted areas receive?

4. What specific activities will the top managers undertake in the targeted area? How will they be prepared for this involvement?

5. How can top management help appropriate middle managers and supervisors to understand, support, and lead this effort in their respective areas?

6. Who will provide technical assistance in each targeted area? How will they be trained? How much of their time will be made available to improvement efforts?

7. What will be monitored in these efforts so that it becomes a learning experience whereby performance can be improved?

8. What are the secondary targets? How might these new targets be prepared?

4. Managers establish processes for the internal coordination, oversight, and technical training and assistance needed to support all quality improvement efforts.[6]

Transformation can't be done haphazardly. Someone must oversee the scores of logistical, administrative, and advisory processes involved in implementing quality. Someone must:

- advise managers, helping them keep sight of the big picture and the long-term vision.
- help managers assess the effect of various transformation efforts to determine what is effective and necessary so that the right things are being done and are being done successfully

- keep track of various improvement efforts; assess needs; coordinate any centralized training.
- coordinate the deployment of in-house technical resources and provide for the continuous education of these resources.
- arrange for seminars and workshops for managers; arrange for managers and others to be presenters and instructors for various workshops and seminars.
- provide technical assistance to the project teams and others engaged in improvement efforts; assist in establishing and educating teams and managers to oversee the project te .ns.
- provide orientation to new managers and other key participants.
- maintain a library of information resources and training materials.
- coordinate publicity for the transformation efforts, such as newsletters. professional journals, trade publications, and local media.

The structure of this coordinating function should begin modestly and evolve modestly just ahead of any planned expansion. It should never become a quality empire. In the beginning. it may be one person, an implementation coordinator. This implementation coordinator should report to the chief executive officer. The implementation coordinator must be a capable leader and have a solid understanding of Deming's teachings and statistical principles and perspectives. Eventually this coordinating function may expand into a small staff that includes a statistician and an organization development specialist. Depending on the size of the organization, there may be satellite coordinating units as well. The coordinator may have a dotted-line relationship to people designated as local-site coordinators or technical advisers. Above all, this coordinating function must never be seen as a unit assigned the responsibility for quality transformation. That responsibility belongs to management. Rather, the coordinator function is a resource providing support services to managers.

5. Managers undertake specific efforts to change the organization's culture to one more supportive of total quality.[7]

An organization's culture is the result of the day-to-day, on-the-job experience of the mass of employees, i.e., What is it like to work here? The collective answer to that question and the following questions will describe the company's culture:
- What survival instincts does one need to develop here?
- What are the unwritten rules—the code of conduct—for the informal organization?
- What are the organization's taboos, sacred cows, clubs, cliques, rivalries, myths, and lore?
- How does working here differ from working at another company in the same business?

Managers, therefore, might well ask questions such as: How does the individual employee feel about working here? How do employees feel about the company? About their respective work groups? About their individual jobs? These questions are important, not because the purpose of a company is to make everyone in the company feel good, but because employees who dislike their jobs, their work group, and the company itself are not ready to join in an unending pursuit of quality. Their trust and cooperation must be earned. Figure 1 describes the combination of factors that constitutes the "quality corner."

If managers are to understand and change the organization's culture, they must learn other things from employees: what quality problems do the employees experience, what stands in the way of pride of work, what stands in the way of teamwork, what would help them feel more a part of the company?

The way to learn employees' answers to these questions is simply to ask them. Managers should conduct focused discussions among relatively small groups; a facilitator can help plan and conduct these sessions. In these discussions managers should also ask what they as managers can do to eliminate fear and barriers, encourage a spirit of closeness to the customer, encourage a common commitment to the scientific approach, and encourage commitment to constant improvement. Sometimes, just the fact that managers are willing to ask these questions a 'd listen to employees' responses can begin to change the culture.

Along the same lines, managers should initiate a review of the company's employee manual, asking:
- Do any of the policies suggest the old concept of the organization?
- How might these policies be changed to complement the new view of the organization?
- Do any policies suggest distrust or disrespect of employees? How might these be replaced with more trustful and respectful policies?
- How can management create a level of pride and respect that will eliminate the need for paternalistic regulation?

Finally, there are three important cultural values that managers should promote within the company. Specific initiatives should be planned in three areas: close to the customer, scientific approach, and constant improvement.

Close to the customer. Managers in every part of the company should organize activities and events that help bring employees and the paying customers and ultimate users together. Managers should help all employees see the customers as real living, breathing human beings who actually purchase, use, and care about the product (e.g., bring in a panel of customers to discuss ways of improving the product or service). These activities should lead to developing planned, institutionalized systems for routine customer feedback.

The scientific approach. Part of the company culture should include a polite impatience with guesswork, shooting from the hip, and opinions offered as fact yet unsupported by data. This shift from guesswork to good data must begin in the highest levels of the company.

Constant improvement. Managers should set an example of constant improvement and recognize those employees who are constantly trying to improve the system.

Activities focused in these three cultural areas tend also to create teamwork. These efforts also reduce fear and barriers and encourage pride in one's work, work group, and indeed, the entire company.

In all of these improvement efforts, managers should employ a sequence of phases that the Japanese call the Deming Wheel and Deming calls the Shewhart Cycle[8]:

Plan: Consider as carefully and thoroughly as possible what you will do and how you will do it. Use data whenever possible in your analysis of the situation. Identify the key factors for success and determine how you will measure the effect of your effort.

Do: Carry out your plan.

Check: As you implement your plan, monitor and evaluate your efforts. Identify areas for improvement.

Act: Incorporate the improvements into your efforts and continue the effort.

Plan: Reconsider what you are doing. Continue the cycle.

► **Figure 1. The Quality Corner**
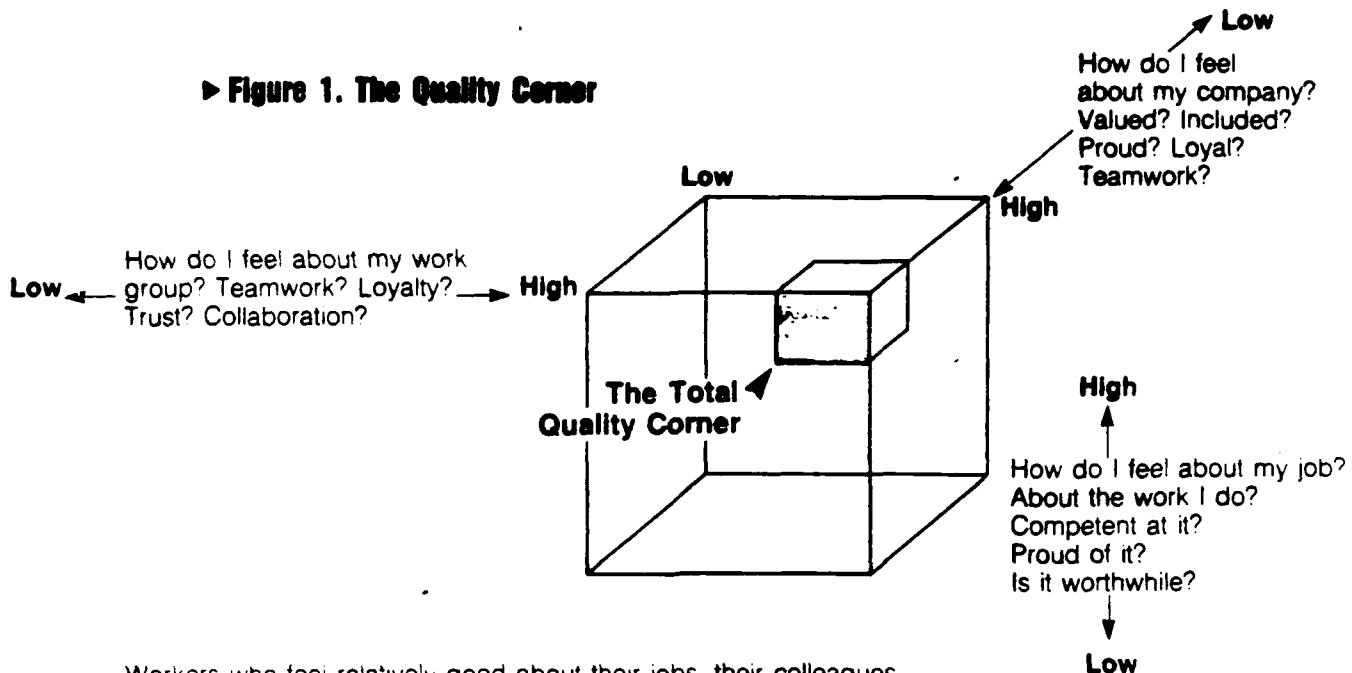
Workers who feel relatively good about their jobs, their colleagues at work and the company at large are more likely to join a never-ending pursuit of total quality

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This cycle should become a constant impetus to improve. Every activity can be subject to the cycle and, eventually, every activity should be.

It is worth noting that management by objectives and performance standards work against a quality-supportive organizational culture.[9] Objectives and performance standards focus on individual performance when the individual can seldom control the system within which he or she must work. They attribute to an individual the work of the group and the system as a whole. People become victims or beneficiaries of normal variations built into the system.

The needs and opportunities for systematic improvement are far more profound and pervasive than any performance appraisal system can possibly accommodate. One must usually choose, therefore, between real system improvements or superficial accomplishments as described in performance objectives.

Performance appraisals are seldom fair, objective, and educational. Given the myriad problems with performance evaluation systems, managers should explore realistic alternatives. Whatever new system emerges, it should allow for legitimate, useful feedback to employees, only on those efforts over which they have true control. The system should encourage teamwork and pride, and recognize constant improvement.

6. Education and training.[10]

The Japanese are fond of saying that quality "begins with education and ends with education."[11] As important as training and education may be, however, these areas also represent a hazard. It is fairly common for a manager to arrange for lots of people to be trained and then wait for results. Such training in quality approaches will be utterly wasted without top management's leadership, planning, and an internal network of coordination, oversight, and support.

These are some of the types of training and education needed to support the quality efforts:

Technical training related to specific job skills. Everyone should have a mastery of the technical skills needed to do his or her job. Everyone with an identical job should do it consistently, eliminating variation from worker to worker.

Systems orientation for all individuals and groups. All employees should understand how their jobs fit into the system, who their internal suppliers and customers are, and how their work affects the final product or service delivered to the outside customer and user.

New technical and maintenance skills. Technical knowledge and skills previously reserved to technicians (for example, engineers and maintenance personnel) should be gradually transferred to operators. Technicians should be viewed as instructors for the hourly workers. In turn, the knowledge and skills of the technicians should be upgraded. The goal is to elevate everyone's level of technical competence.

Basic orientation to quality. This includes presentations on such topics as the history of the quality movement, the essentials of quality and transformation, the organization's approach to transformation, and the plan for transformation. These should be taught to everyone at an early stage of the transformation effort.

Technical adviser training. Early in the implementation of quality, an organization should begin developing an internal network of personnel that is capable of providing consultation and technical assistance to those engaged in improvement efforts. These individuals know the basic tools of the scientific approach, the skills of project planning and management, and the basics of team development and meeting management. The technical advisers also know how to teach these skills to others.

Basic improvement skills. Gradually everyone in the organization should learn: how to plan and manage an improvement

The Quality Transformation cont.

project; how to work in groups; how to plan a change; the basic scientific tools; and how to gather data to determine the sources of problems and variation. (These skills should be taught to employees as they need them. We call this just-in-time training and see the technical advisers as the main suppliers of this training within the organization. Mass training of employees in the improvement skills is, in our judgment, a substantial waste of time and resources.)

Quality leadership: education, training, and development. Managers, key staff, superintendents, and supervisors at every level will need help in understanding quality and how to lead the transformation. They will need to understand their new jobs as redefined within the new view of the organization. They will need to learn new skills, such as planning, group and meeting management, and inquiry skills.

There are three areas that leaders should study from the beginning and understand deeply. First, they should study Deming's teachings. Second, leadership study should focus on variation. Managers who do not understand variation cannot manage effectively. One cannot appreciate Deming's teachings without an understanding of variation.[12] The third important area of management study is statistical thinking and the use of data. Statistics is not just a collection of mathematical tools. It is a way of thinking, a method of judgment and discernment that requires a perspective not commonly shared in everyday life. The right statistician can be an invaluable resource to help managers understand variation, the statistical perspective, and Deming's teachings.

Education and training must be a pervasive effort in the transformation. Early planning for transformation should include the beginning training and education programs and how these will expand and be followed by other programs.

The transformation to a quality organization is a complex, difficult undertaking. The way to go about it is not in the manner of the bulldozer; rather, you can accomplish transformation in the manner of the boll weevil: patiently and persistently, inch by inch and row by inexorable row. Convert one process after another, eliminate one barrier after another, strive for constant improvement and continuous education. Develop a pace of change that doesn't overextend your ability to coordinate and support.

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8. See Deming, *Out of the Crisis*, p. 88, and Ishikawa, *What is Total Quality Control?*, pp. 17, 59, and 93-94.

9. For more on this, see Deming, *Out of the Crisis*, pp. 70 ff. and 101-120. Andrew Grove, *High Output Management* (New York: Random House, 1984), chapter 11, has some interesting comments on motivation and feedback that are directly related to this issue.

10. For good basic references on education and training in a quality organization, see Deming, *Out of the Crisis*, pp. 52-54 and 86; Juran, *Quality Control Handbook*, section 17; Ishikawa, *What is Total Quality Control?*, pp. 37 ff.; Gitlow and Gitlow, *The Deming Guide to Quality and Competitive Position*, chapters 6 and 13; William Scherkenbach, *The Deming Route to Quality and Productivity: Road Maps and Roadblocks* (Washington, D.C.: The CEEP Press, 1986), chapters 11 and 12; and Harrington, *The Improvement Process*, pp. 98 ff.

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Total Quality Management as an Organizational Change Effort: Implementation Requirements

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Total Quality Management as an Organizational Change effort: Implementation Requirements

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American industry has been the world-wide productivity leader for most of this century. Being in this position indicates that many of the "right" business decisions and practices have been undertaken. And since these undertakings have historically led to such positive results, there is little motivation to change the way these businesses need to operate--in terms of management philosophies, strategies, and planning cycles (McHugh, 1985). Over the past few years, however, this world-wide dominance in productivity by the United States, has been seriously challenged in many industrial arenas (such as the automobile, electronic, and optical equipment industries). While a variety of reasons have been offered to explain the declining productivity and competitiveness, such as the oil crisis, governmental regulations, and unfair trade practices (Mroczkowski, 1985), American managers are also realizing that the past ways of operating, that is, the traditional ways business decisions and practices were made, may not be the most effective or the "right" ways to continue to operate in the future.

As U.S. industry began to suffer from dwindling world markets and profits, compounded by the recession of the 1970's, American business leaders not only looked to changes in technology, but also to changes in their management practices. In particular, they focused on the management methods employed and practiced by their strongest competitor, Japan. Many industry leaders began to study, adapt, and implement some form of the quality/productivity improvement approaches used by many Japanese businesses. An approach that has received much attention over the past few years has been referred to by many names, such as process control, statistical process control, total quality control, quality management, and total quality management. Interestingly, while these management orientations have been thought to have a Japanese genesis, Japan's exposure and implementation of process control principles have actually been attributed to American sources. As part of the program to assist Japan's recovery from the economic effects of World War II, a group attached to General MacArthur's command taught a set of management and statistical principles to prominent Japanese business executives on the essentials of quality and productivity in manufacturing (Hopper, 1982). These principles had been developed and used in American industry prior to World War II. The courses laid the groundwork for Japan's acceptance of the teachings of W. Edwards Deming and Joseph M. Juran during the 1950's.

The focus on improving "quality" through controlling work processes, the basis of the teachings of Deming and Juran, (although they differ in specific applications), is the core of the present Japanese approach. Simply, this approach attempts to constantly improve product and/or service quality by monitoring the processes through which products or services are produced. By correcting steps in the process, improvements in quality will result (Ishikawa, 1985). Improvements in quality leads to improvements in productivity because product/service variabililty is reduced which, in turn, leads to fewer defects, less rework, less waste, and fewer customer complaints. To date, these types of approaches have been implemented, in various degrees, in a variety of manufacturing organizations, such as Ford, General Motors, Polaroid, ITT, IBM, and to a lesser degree in basically service-type organizations, such as the Equal Employment Opportunity Commission (EEOC Report, 1935).

The Navy has recently become interested in applying process control principles and procedures in many of their industrial organizations. In particular, the Naval Aviation Depots (NADEPs) have been involved, to various extents, in assessing the effectiveness of process control principles as they apply in their respective work environments.

The purpose of this paper is to discuss some of the issues involved in the implementation of an organizational change in general, and specifically in implementing Total Quality Management (TQM) principles and procedures within a NADEP. TQM is the name given the combined implementation of process control principles with the use of statistical process control procedures, such as structured problem solving and graphic techniques.

Organizational Change

The organizational change process has been characterized as the progression through three basic sequential cycles (Clegg, 1979). Simply, these cycles consist of (1) diagnosis, (2) implementation, and (3) consolidation and evaluation. The diagnosis process has had many labels; initiation, mobilization, issue perception, and goal and attitude formation among others (Sheposh, Hulton, & Knudsen, 1985). Diagnosis involves an awareness of a problem within the system, or an unsatisfactory imbalance between the organization and the environment in which it operates. This realization leads to an assessment of the available resources and to the determination as to what changes can be made to the organization to reduce the imbalance. This is where the implementation cycle begins.

Implementation consists of making the desired changes an integral part of the way the organization operates. Consequently, members of the organizational units affected by the changes will be required to adhere to the changes. This phase is fraught with difficulties. Metz (1984) suggested that many attempts to improve productivity and quality will elicit positive results, albeit short-term. Most change efforts fail to have long-lasting and significant improvements because they do not effect the structure of the organization, the changes are not institutionalized (Nadler, 1981; Porter, Lawler & Hackman, 1975).

The third cycle involves the consolidation of the new method or change and its evaluation. Consolidation consists of the process of acceptance (behavioral and attitudinal) of the change and how it effects and interacts with the rest of the organization (Clegg, 1979). The evaluation consists of both formal and informal assessments of the effectiveness and success of the implemented change.

Implementation Issues

Over the past few years many organizations have implemented, or at least acknowledged the need for, various productivity and/or quality improvement efforts (Metz, 1984). For the most part, these implementation efforts have been responses to competitive "crises" and have primarily focused on achieving short-term outcomes. Characteristically, these attempts have obtained limited success in improving quality and productivity and in becoming an integral part of the organization's structure (Metz, 1984; Schilling & Bremer, 1985). During the 1970's and early 1980's, many organizations employed some type of productivity improvement effort, such as, management-by-objectives (MBO), quality circles, quality-of-work-life (QWL), incentive awards, or profit sharing. However, while many of these efforts initially generate high levels of enthusiasm, they typically do not maintain the consistent and long-term levels of acceptance, activity, and involvement required to ensure positive and lasting effects. Thus, many companies will attempt many different approaches in the hopes of hitting the "right" one. Unfortunately, this approach frequently leads to the development of attitudes among employees that the company is attempting to implement yet another "program" in yet another attempt to eliminate its problems (Metz, 1984; Schilling & Bremer, 1985). Consequently, employees learn how to "accept" management's short-term changes, often by benign neglect or by focusing on "higher priority" concerns, until the new program is supplanted by an even newer program.

Metz (1984) has identified three general productivity and quality improvement implementation approaches. These approaches vary in the extent to which they are integrated into the culture and structure of the organization. These improvement approaches consist of: productivity/quality programs; quality of work life programs; and organizational redesign. The most difficult approach to implement is one of organizational redesign. This approach requires a systematic strategic plan which leads to changes in the way the organization operates. The other two approaches include the introduction of additional "new programs", which may require some level of employee cooperation, but generally do not necessitate that changes be implemented with how the organization functions. These programs are presented as discrete activities and are neither specifically intended nor are they perceived as being tied in to the way the organization does business. Priorities to these programs are usually determined only

after other "more important" concerns are addressed. They are often perceived as having a relatively short shelf-life, that is, they will "go away" after a finite period of time. However, the companies that have implemented organizational redesign have come to the realization that organizational effectiveness is a function of the extent to which an organization systematically changes it's social, technical, and administrative subsystems in congruence with a long-term strategic change plan.

The primary focus of this report is on implementation. Sheposh et al. (1983) reviewed the limited number of empirical studies on the implementation of planned change. They reported that both organizational factors (such as centralization and size) and individual factors (attitudes and perceptions) interact with and influence each other as well as affecting the changes being implemented. These interactions often determine the extent to which a change can be tolerated by the organization, either by its present structure or in the attitudes of its members.

Organizational Climate

Organizations generally convey, through the way they are structured and/or through the relationships they foster with employees, whether change or innovation will be tolerated, supported, and/or encouraged. The specific characteristics that indicate the way an organization is structured and relates to its members has been defined as organizational climate (Campbell, Dunnette, Lawler, & Weick, 1970). Some ambiguities exist in the conceptual distinctions between organizational and psychological climate (James & Jones, 1974; Jones & James, 1979). Nevertheless, this concept is a useful way to distinguish between organizations (Drexler, 1977) and the types of behaviors supported in different organizations (Forehand & Gilmer, 1964). An organization's climate is reflected in the attitudes its members hold towards the organization. Organizational climate has been measured by objective and perceptual means. Objective approaches to organizational climate have generally characterized organizations in terms of their structural properties, such as size, levels of authority, and degrees of formality (Evan, 1963; Lawrence & Lorsch, 1967; Prien & Ronan, 1971). More typically, however, climate has been characterized as a set of measurable properties of the work environment as perceived by those working in that environment. These perceptions reflect attitudes towards work environment factors such as supervisors, peers, the organization in general, communication, and satisfaction. These perceptions are linked to subsequent influence on work motivation and job performance (Litwin & Stringer, 1968; Siegel & Kaemmerer, 1978) and whether innovations are likely to be supported and implemented. Thus, the "climate" in an organization can set the tone for whether members of that organization perceive the implementation to be a legitimate attempt towards programmatic change or just another short-lived management exercise.

Factors for Successful Implementation

Siegel and Kaemmerer (1978) have suggested five important elements that contribute to the liklihood of an implementation being successful. These are:

1. LEADERSHIP: which consists of displays of support for the innovation and establishes the legitimacy and commitment of resources necessary to ensure its implementation.

2. OWNERSHIP: or involvement of the people who will be effected by the change. Employees, at various organizational levels, who assist in the development and implementation of the ideas, processes, and procedures that will effect them will generally feel greater commitment to the change.

3. NORMS FOR DIVERSITY: whereby "new" attempts to resolve problems and issues are tolerated and encouraged. The emphasis here is to use procedures which will improve operations no matter how unique, rather than limiting corrective actions only to past ways of addressing problems.

4. CONTINUOUS DEVELOPMENT: consists of attempts to identify improved ways of solving organizational problems. Although they may identify solutions, present problem solving approaches may still

be made more efficient by continued improvement efforts. An organization must take a supportive attitude towards employees who engage in activities which attempt to modify and improve operations.

5. CONSISTENCY: between the organization's processes and desired products. Members of the organization must be able to understand the relationship between the way a product or service is processed and the end-product (outcome). This element focuses on having an understanding of the "big picture" within the organization. This may help to clarify where an employee "fits" in the company.

In a different approach, Metz (1984) identified six major implementation characteristics and how they related to the three implementation approaches discussed earlier (productivity/quality programs, QWL programs, organizational redesign). These characteristics consist of the official banner, measurements, methodology, responsibilities and leadership, employee involvement, and strategic focus.

Banners: refer to the labels and other identifiers used in describing the type of implementation approach selected, that is, the amount of change required in the organization (innovation development, innovation application, innovation institutionalization).

The measurement: characteristic emphasizes the relationship between qualitative (attitudes) and quantitative (outcomes) factors and how changes or improvements are documented. Too much emphasis on measurement may be as non-constructive as not enough.

Methodology: refers to the way the organization goes about implementing the change; from simply adding a new program to restructuring the basic reporting relationships in the organization.

The responsibilities and leadership: characteristic focuses on the degree of active top management support and the amount of management involvement in aspects of the change.

Employee involvement: considers the amount of personal involvement in the implementation, by all levels within the organization.

Strategic focus: refers to the time frame and the types of functions (e.g., technical, marketing, R & D, finance, and human resources) included in the strategic planning process. In other words, how comprehensive is the plan that is developed?

Peters and Waterman (1982) analyzed the organizational operations and management philosophies of many American organizations. They report the characteristics they consider to be important for identifying "excellent" organizations. These factors include:

1. a bias for action, that is, not being afraid to experiment, to evaluate changes, and in general to take some actions in order to try things out;

2. staying close to the customer, that is, frequent interactions with and identification of customers' needs;

3. autonomy and entrepreneurship, that is, support for idea generation which is separate from the formal organizational processes; this orientation includes risk-taking;

4. productivity through people, that is, supporting the active participation, involvement, and input from employees;

5. hands-on and value-driven, that is, the involvement of top management with organizational operations (down to the bench levels) along with clearly stated and understood company values;

6. stick to the knitting, that is, if diversification is to occur, focus on single skills or branch out

into related areas;

7. single form and lean staff, that is, maintain a relatively simple organizational form, one that is flexible and not an end in itself;

8. simultaneous loose-tight properties, that is the combination of centralized direction with an emphasis on individual autonomy.

The three efforts described above reflect each of the authors' personal experiences with organizations and indicate that both structural and attitudinal/behavioral changes are necessary for successful implementation. While they propose many similar activities, each contributes something unique to determining what is necessary for an implementation to be successful. The review by Sheposh et al., (1983), indicated a preponderance of studies which focused on individual factors, primarily the role of management. Top management commitment was consistently identified as one of the ingredients necessary for any innovation to remain permanent. However, while the literature supports the importance of management commitment to the change, it does not discuss the WAYS in which this commitment can be integrated into the organizational structure and support system. One reason why many innovations or change attempts fail may be because the organizational support systems have not provided for structural changes as well as program changes. Consequently, we may have a situation in which management reports they support a particular change, however, no significant organizational structural or operational changes are correspondingly made. Similarly, the structure may be changed but the social support required to make it an effective and long-term change may not have been established.

IMPLEMENTATION OF TOTAL QUALITY CONTROL

To obtain a better understanding of the factors that contribute to a successful TQC implementation, NPRDC visited nine corporations which had been operating under some type of process control system. Seven significant implementation elements were identified (Houston, Shettel-Neuber & Sheposh, 1986). These elements consisted of the: (1) development of management awareness and commitment, (2) development of a positive work climate, (3) development of a supportive management structure, (4) designation of a leader for quality, (5) establishment of training at ALL organizational levels, (6) establishment of pilot projects, and (7) the need to allow adequate time for results to occur

These seven elements, in conjunction with published research, were combined to develop a set of implementation approaches deemed appropriate and feasible for a quality management system within the NADEP community. The six major categories are:

I. Top Management Orientation

II. Structural Changes: Management and Administration

III. Training for all Levels

IV. Quality Improvement Actions

V. Support Activities

VI. System Expansion

A set of 35 specific activities were developed within these six major categories. Many of the specific activities should run concurrently. It is not the purpose of this paper to describe each of these specific steps, however, a general description of the major categories will be given.

- 5 -

Top Management Commitment:

The basis for a successful implementation requires establishing an awareness of and commitment to the desired changes, specifically to total quality control philosophies and activities. Awareness may be relatively easy to achieve because most managers will agree that organizational improvement is both desirable and possible. Commitment, (as presently defined) however, may be more difficult to achieve because it requires behavioral changes, that is, a reallocation of resources in terms of money, people, and time. A commitment to quality improvement will require a change in the corporate culture. Changes to the social, structural, and political arenas need to be addressed.

Resistance to Change:

Generally, one of the first problems is that of a RESISTENCE to the change (Nadler, 1981). Resistance may occur for a variety of reasons, such as lack of stability, security, uncertainty about the future, and concern over finding alternative ways of coping, adjusting, and managing. A strategy to minimize resistance is to motivate changes in the behavior of those people who will be most affected by the organizational changes (Nadler, 1981). Commitment from top management has been identified as one of the first and most important steps in the implementation of change (Metz, 1981; Mroczkowski, 1985; Schilling & Bremer, 1985). However, the most effective way to establish commitment still remains unanswered. Nadler (1981) suggests a way to build top management support is to surface both the potential problems and benefits of the new approach and compare them to the actual problems and benefits of the current state.

Lewin (1947) was among the first to identify the need to "unfreeze" people out of their inertia in order to be receptive to change. The "motivation to change", in part, is expected to result from a dissatisfaction with the present system and a recognition that the intervention, that is TQM, will result in improvements. A way to facilitate implementation would be to use organizational data that reflects a discrepancy between present states and desired states (Nadler, 1981).

One of the most consistent research findings indicates that PARTICIPATION in the change decision-making process tends to reduce resistance (Coch & French, 1948; Kotter & Schlesinger, 1979). Participation has the advantage of facilitating communication and information between participants and, in part, developing feelings of ownership for the change effort. Activities, such as participation in the actual implementation planning process, discussion of the pros and cons of the TQM approach relative to the "old ways" of doing business, development of a mission statement, and a working through of general and specific goals, values, and objectives are required of top and middle management for a change to be accepted.

Rewards are another important area to consider when attempting to minimize resistance to change (Lawler, 1973; Nadler, 1981). A way of integrating the implementation into part of the way the company conducts its business is to reward employees, in some way, for engaging in desired behaviors. The planners of the implementation need to identify the rewards that can feasibly be allocated to employees who engage in the appropriate activities. The rewards can include either financial incentives, such as bonuses, pay raises, promotions or non-financial incentives such as recognition, status, job enrichment or increased responsibilities. A word of caution must be mentioned here. Clarity needs to be established between the desired behaviors and the reward. Employees are often EXPECTED to behave in certain ways, yet are rewarded for conflicting behaviors (Kerr, 1975). This issue has yet to be addressed, at least from a formal perspective, for the NADEP organizations.

Implementation Activities:

Metz (1984) has identified four steps, that are within the perview of top management, that will facilitate the implementation of an organizational change. They are: (1) the need to develop a

philosophy or mission statement; a clear statement that must specify what the organization is all about; what business it is in; and why it exists. Pearce (1982) presents a good description of the components and uses of the philosophy statement. (2) The goals and values of the organization need to be clearly stated. Top management needs to clearly communicate what they hope to achieve and accomplish by the innovation. Included will be such things as statements of the organization's long and short term goals and the general means to achieve them. (3) A management steering committee should be formed. Such a committee needs to clearly express top management's support for the implementation. This group will not only make plans and decisions regarding the changes, but will also facilitate the transition from the the present to the future state of the organization. And (4) top management needs to develop a strategic change plan. This plan will provide the focused business strategy that will guide and direct the organization towards improved quality and productivity. This plan is the key to linking specific improvement activities into a systematic and coordinated effort.

Structural Changes: Management and Administrative:

After awareness and commitment, the second phase in which the difficult process of actually changing the structure of the organization begins.

One of the most important structural changes that can be made is to facilitate communication flows between and within levels of the organization. One way to do this is through the establishment and use of "Quality Management Boards" (QMBs). The QMB structure was adapted from Ackoff (1981). QMBs exist at all levels within the organization. For a NADEP, this would consist of the directorate level, the department level, the division level, the branch level, at the section level, and at the shop level. Each board consists of members from that hierarchical level in the organization, such as the division level, and includes a representative from the immediate level above, such as the department, and the immediate level below, such as the branch. These two additional members serve as "linking pins" to their respective QMBs. In this way, communication flows (up, down, and horizontally) would be clearly tied to QMB participation. Membership on these boards includes all of the people involved in the improvement of a particular work process. Thus, for a production process, participants might include representatives from production, methods and standards, scheduling, production control, and production quality. The shop level equivalent of a QMB is called a project team. The team is mainly comprised of artisans and/or foremen who work on a specific process. Teams are specifically formed to address a particular concern, such as a recognized production problem. After that concern has been adequately improved, the team may not be required to meet regularly. However, a subset of the members should continue to monitor the improved process to insure that it continues to function efficiently. The progress and results of a team's efforts would be reported to the next highest level QMB, the section level, which would in turn report the activities to the next level, and so on. Multiple teams may be formed within the same shop and may even contain many of the same members. In the initial stages, processes selected to be improved may come from higher level boards. However, as teams become established and gain experience working together and are able to see that the changes they recommended are being implemented, they may begin to identify and work on problems and processes they themselves have chosen to address.

Ideally, as a way of maintaining this type of structural change, the organization's incentive system could be used. Rewards could be of various forms, such as, part of the appraisal system or part of the cost savings system for example. If no tangible rewards were available, at the very least some intangible or intrinsic considerations such as autonomy, responsibility, and feedback would be expected to be provided as a result of participation in a QMB.

Training for All Levels:

The third phase of the implementation process consists of the training which accompanies changes in the organizational structure. The specific TQC training curriculum, developed by NPRDC,

is described in another source (Hulton, 1984). Training serves as the mechanism by which the "new" philosophies and organizational changes are imparted to members of the organization and also by which the strategies and techniques needed to accomplish the new goals are provided. Not only are members of the organization provided with an opportunity to obtain a better understanding of how the company should operate, it also receives the specific tools it needs to insure that its employees can achieve these goals. For a large organization, like a NADEP, the training must be done in stages. Eventually everyone should receive training. Consequently, the logistics required to accomplish this task becomes crucial and must be carefully planned. The focus of the training is twofold. One, a clear presentation and specification of the philosophy that is being promoted must be taught and understood before it can be accepted. This point is especially true for top and middle management. The second phase of the training is centered on the specific methods which best operationalizes the philosophy. It provides the tools that can be used to monitor, control, check, evaluate, and improve work processes. Specifically, we focused on group problem-solving techniques and charting procedures.

However, training in team related activities is needed in addition to the problem solving and charting procedures. In our experiences, we found that for many group members, the only type of interactions they had with each other were negative. Allegiances, as would be expected, were most often tied to specific departments or individuals and not with the process of production, manufacturing, or repair. Many of the interactions resulted in loud and accusatorial finger-pointing and accountability-avoidance sessions. In order to get people to work together cooperatively, team building activities, in addition to ways to conduct efficient and productive meetings need to be included as part of a training package (as well as the technical activities associated with quality improvement).

Quality Improvement Actions:

The fourth phase of the implementation begins with the process of problem reduction. These activities include discussions of the process to be investigated, the procedures used to collect data, and the methods of documentation. During this phase, the roles of the various QMBs and the project teams need to be clarified and the extent of responsibility and accountability assigned to each much be stated. While decisions concerning changing the work process should be deferred to the lowest relevant QMB level, the boundaries for each of the QMBs need to be clearly specified. Not only should data be collected on process functioning during this phase, but also the attempts to improve it and to continue monitoring it should be part of this phase of the implementation. Appropriate procedures to record the actions and activities that occur in the QMBs or project teams should become part of each groups' operating procedures. These documentation efforts can subsequently be used for archival, evaluative, and/or descriptive purposes.

Support Activities:

While specific actions are required to establish and to implement organizational change, additional activities are needed to maintain and support the "new" system. Many of the activities in this phase are efforts that should be taking place concurrently with the previous phases. Throughout the entire implementation process, an informational or public relations capability needs to be developed and used. A plan for disseminating information about the implementation activities should be developed early in the process. In-house publications, announcements, and general organized discussion sessions can be used to address this goal. A method of reporting and publicizing the on-going activities, progress, and the results of the QMBs and project teams needs to be established. A single individual should be selected and given the responsibility for accomplishing this task. Additionally, easy access to a variety of resources should be provided. These resources include access to the individual or group of individuals associated with and most knowledgable about the changes. This person (people) should be one who is respected and who can be easily approached with questions about the implementation. Library materials such as books, articles, videotapes, and journals containing relevant quality management materials also should be maintained.

System Expansion:

As processes and problems are addressed and resolved through the QMBs and project teams, activities need to be undertaken which will institutionalize the process improvement activities which were found to be most successful. As the quality management efforts begin to reduce nonproductive work behaviors and as the indicators of effective performance begin to improve, the activities associated with these improvements will need to be codified and institutionalized. A strategic plan will need to be developed which will identify the additional organizational units which will most likely benefit from the implementation. Schedules which provide when the appropriate training for these various groups will be provided can then be developed. A useful training technique by which to present the training materials would be to have individuals who had previously been trained to serve as subsequent instructors.

CONCLUSIONS

The focus of the present effort has been upon the implementation of a specific organizational change, Total Quality Management. As discussed, many problems arise in connection with implementing a major organizational change such as TQM.

In the establishment of a lasting organizational change, it is important to remember that changes that are just focused on changing individuals, by means such as training, group process activities, and attitude change attempts will not last long unless they are accompanied by structural changes as well (Nadler, 1981; Porter, Lawler, & Hackman, 1975). Based on the information gathered to date, the following types of individual and structural activities are suggested as the ways most likely to facilitate the successful implementation of an organizational change such as TQM.

1. A clear and specific mission statement. The organization needs to provide a clear statement of why it is in business. Included should be the organization's philosophy and values that is, the climate and culture it wants to foster, what the company stands for, where it would like to be in the future, and what it would like to accomplish.

2. The formation of a transition steering committee. A group of individuals who are respected, have power and authority within the organization, and are knowledgable about the implementation, needs to be assigned the task of managing the changes. These individuals should be able to make decisions over resources, publicity, training, and other activities that will be addressed in order to implement the innovation.

3. The development of an implementation plan. Nadler (1981) suggests that such a plan will expedite the movement of the organization from the present state to the future, desired one. Such a plan needs to provide for the indicators of performance and the activities that have occurred and are presently occurring regarding the implementation. In other words, a method of providing feedback which will indicate the progress of the intervention needs to be identified. In this way, appropriate adjustments can be made to the system. This plan should include an identification of the key activities required (such as training), those given responsibility for these activities, a timetable for when these activities should occur, and indicators of the feedback required to identify the relative success (or failure) of the implementation.

4. Establishment of structural changes required to implement the change. As discussed previously, it is necessary to modify the organizational structure in order to secure lasting change. While these activities should be part of the implementation plan itself, they are presented separately here to highlight their importance. As part of the on-going effort at a particular NADEP an attempt was made to modify a division's communication and reporting structures through the establishment of QMBs. This division is serving as a prototype for the entire organization. In this way pilot or experimental units can serve as test beds for refining intervention and implementation plans. Also, by establishing pilot units

structural changes can be evaluated in terms of their feasibility, applicability, and effectiveness.

5. Information on TQM activities, regularly and systematically provided to members of the organization. Another activity, that should be included as part of the implementation plan, is the attempt to provide the organization with clear and accurate information, from top and middle management, on the status of the changes and their implications for the organization. Updates should be presented frequently. Management should indicate their support by verbal, written, oral, and behavioral messages.

While the above activities identify some of the things considered most appropriate to the successful implementation of organizational change, not all of them have as yet been fully accepted by all of our host organizations. Nevertheless, the general need to establish organizational acceptance of the concepts of quality and continuing process improvements has been recognized. The ways to obtain this acceptance however, are still unresolved. In this regard, organizations may need to experience and experiment with specific changes before they accept the entire innovation. Consequently, various aspects of each of the above approaches are presently being assessed in several of the NADEP organizations. For example, changes in organizational structure are being tested on a pilot basis in several organizational units. Training is progressing at various rates of speed and at various organizational levels. The development of mission statements, implementation plans, and the formation of steering committees are also in various stages at the different organizations. Information is being collected on changes in a set of organizational outcome measures, such as product factors (quality, quantity, and process improvement), structural changes, and institutionalization efforts, as well as a set of individual measures such as climate changes, changes in perceptions of the job, relationships with supervisors, job clarity, and levels of participation.

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SECTION 3:

QUALITY IMPROVEMENT STRATEGY

3-1   Greebler, C. S., & Suárez, J. G. (April 1989). *Strategy for Educating the DoD Acquisition Work Force in Total Quality Management* (NPRDC Tech. Note 89-19). San Diego, CA: Navy Personnel Research and Development Center.

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3-1

Strategy for Educating the Department of Defense Acquisition Work Force in Total Quality Management

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Navy Personnel Research and Development Center
1989

SUMMARY

PURPOSE

The purpose of this strategy is to provide broad guidelines for planning and coordinating a Total Quality Management (TQM) education and training program for the DoD acquisition work force.[1] The primary emphasis is on acquisition managers, although successful implementation of TQM will ultimately require educating and training of the entire work force. Part of the strategy is to capitalize on the TQM training resources (courses, instructors, etc.) already in existence within DoD. TQM capabilities which have been developed within the DoD logistics system can be transferred to the acquisition system, to be supplemented with resources external to DoD.

OBJECTIVES

This strategy has two objectives. The first is to describe the educational requirements for a TQM awareness program for managers that provides them with an overview of TQM principles and concepts. The second is to describe program goals, guidelines, and resources available to DoD training developers and managers who will subsequently be responsible for follow-on education and training of their subordinates.

BACKGROUND

The Office of the Secretary of Defense has created a master plan for the implementation of TQM in DoD. The initial focus of this implementation is the acquisition system. Central to this implementation is an integrated education and training program for the acquisition work force. Education in this context is that portion of the program concerned with the teaching of TQM principles and concepts. Training concerns the learning of skills and methodologies used in the application of TQM. The intent of this program is to institutionalize TQM within organizations through a continuing cycle of TQM education, training, and on-the-job applications.

The use of TQM began in DoD in the early 1980's in a few DoD logistic-type field activities. In 1987 its use began to rapidly expand with the advent of support from senior management. TQM is now one of the Department of Defense's primary initiatives. There is particular interest in seeing it applied to improve the acquisition system.

GOALS

Long-, mid-, and short-range goals have been developed which will contribute to the successful institutionalization of TQM in the DoD acquisition community.

Long-Range Goals:

The process of educating DoD acquisition personnel in TQM will be in place, with the majority of the work force trained. Acquisition personnel who deal with the top 20 defense

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[1]Services will have responsibility for developing their own implementation plans.

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contractors will receive extensive education and training in TQM. TQM will be integrated into ongoing DoD education programs, with training supplemented by outside public and private educational institutions.

Mid-Range Goals:

A critical mass of acquisition managers will be trained in TQM, with TQM integrated into ongoing acquisition curricula and into existing professional development channels. Acquisition managers responsible for specific weapons programs will receive extensive training.

The training program for TQM facilitators and statistical experts will be in place. Continuing education packages will be developed and distributed for broad use, with course developers concentrating on programs for specific applications. Those involved in design, delivery, and evaluation of education will use TQM methodology to facilitate their work and to ensure quality programs.

Short-Range Goals:

Following development of a TQM education and training strategy, other detailed plans will be developed that address training of course developers, facilitators, statistical specialists, and TQM coordinators. A survey will be conducted to assess TQM training resources available in both the public and private sectors. A DoD TQM resource center will be established and a survey conducted to assess TQM training resources in both the public and private sectors.

DISCUSSION

An effective TQM education and training program should cover (1) quality awareness and TQM philosophy, (2) action-oriented skills, which include use of statistical methods to analyze processes, (3) group development skills, such as team building, and (4) knowledge about changing organizational culture and overcoming barriers to implementing TQM.

Eventually the entire DoD acquisition work force must be trained. However, initial emphasis should be put on (1) personnel managing TQM implementation, (2) education developers and future facilitators and instructors of TQM, (3) senior and mid-managers, and (4) individuals responsible for coordinating TQM implementation and training within specific organizations.

Successful TQM implementation requires continuing education and training. Follow-on training needs to be tailored to specific jobs and organizations and should be determined after a needs analysis is conducted and objectives established. Needs analyses of the different subgroups (hierarchical and functional) will help to identify specific training requirements and optimal content and delivery methods. Special training courses for persons who will be assigned as TQM statisticians or coordinators for TQM efforts within organizations are needed.

Curriculum development requires identifying the individual learning styles of students and matching instruction methods to them. Courses must be prototyped, tested, and evaluated. This task should be assigned to education development specialists in the DoD schools or commands who have or will have TQM expertise.

DoD must focus efforts on developing competent instructors to support an educational program in TQM. These instructors should have both TQM and training expertise as well as facilitation skills.

Delivery of TQM education should be provided within the current infrastructure as much as possible to keep costs down. Potential delivery sources for TQM education include DoD schools.

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other organizations within the federal government (DoD and other departments), state and local governments, academic institutions, and the private sector (e.g., consultants, learning institutes).

Developing a DoD resource center is also necessary for an effective education and training program. As part of the resource center, a case study data bank should be created to facilitate the dissemination of information gained from TQM implementation.

RECOMMENDATIONS[2]

1. Develop a management infrastructure for the TQM acquisition education and training program. Responsibilities will include reviewing and modifying this TQM education and training strategy and drafting specific action plans, identifying specific requirements for all TQM follow-on education and training, and coordinating inter- and intra-Service activities associated with training.

2. Identify issues related to funding TQM education and take programming and budgeting actions where necessary.

3. Educate course developers, instructors, evaluators, and facilitators.

4. Design awareness courses:
   • 1-day for senior management
   • 6-days for general management

5. Determine delivery agents and locations (e.g., schools).

6. Conduct awareness courses; modify, package, and distribute them.

7. Develop TQM follow-on training programs and programs designed to meet special needs of organizations.

8. Evaluate methodology for both individual courses and the overall TQM education program.

9. Establish a TQM resource center.

10. Integrate TQM education of DoD personnel and defense industry into public and private educational systems in addition to using government sources of education.

11. Integrate TQM education and training into the professional development of DoD employees.

12. Conduct research on the most effective and efficient means of educating senior management in TQM.

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[2] The Defense Acquisition Board will be responsible for determining which committees and/or boards will carry out these actions.

3-2

Training for Quality Improvement

Ted Cocheu

Training for Quality Improvement

By Ted Cocheu

The author of ASTD's popular Info-Line on quality tells how to prepare for a quality-improvement program in your company. Covers where to start, whether to make or buy the training, the role of the trainer, and a sample curriculum.

In the modern world of global competition and rising customer expectations, quality is the new battleground on which corporate success is determined. Organizations in both the private and public sectors are feeling mounting pressure to improve the quality of their products and services. Only organizations that can meet or exceed customers' rising expectations will survive and prosper.

Customers are not only demanding the highest quality available worldwide, but also expect to pay less for it. Fortunately, improved quality and lower costs go hand-in-hand. David Kearns, chairman and CEO of Xerox, believes that "one-fourth of all work in American industry is done to correct errors." Significantly reducing that number by improving quality allows organizations to increase productivity without increasing costs. The Strategic Planning Institute, in research on 3,000 businesses, has convincingly shown that as quality increases, productivity, market share, profitability, and return on investment also increase. The Institute's analysis also shows that quality was the cause of the other increases.

No wonder executives are increasingly looking to quality improvement as a key element in their competitive strategies.

Many experts consider comprehensive training to be the foundation on which successful improvement programs are built. But, since quality improvement is an organizational change effort, training is only one important element in an organization's overall strategy. Other key elements in a quality-improvement strategy must include cultural change, active management participation, a structured approach, customer orientation, employee involvement, a drive toward error-free work, articulation of a compelling vision, a philosophy of continuous improvement, and the use of quantitative methods. Quality improvement must be approached from a holistic perspective to result in meaningful, lasting change.

Training for quality poses special challenges and presents unique opportunities for training professionals. This article provides practical guidance about how to prepare for, design, and implement training programs to support your organization's quality-improvement process.

Preparing to train for quality

Quality experts disagree on the precise definition of quality and the specific steps needed to achieve it. But they all agree that a comprehensive training curriculum is critical to providing everyone in the organization with the knowledge and skills to fulfill his or her quality-improvement responsibilities. Training must include
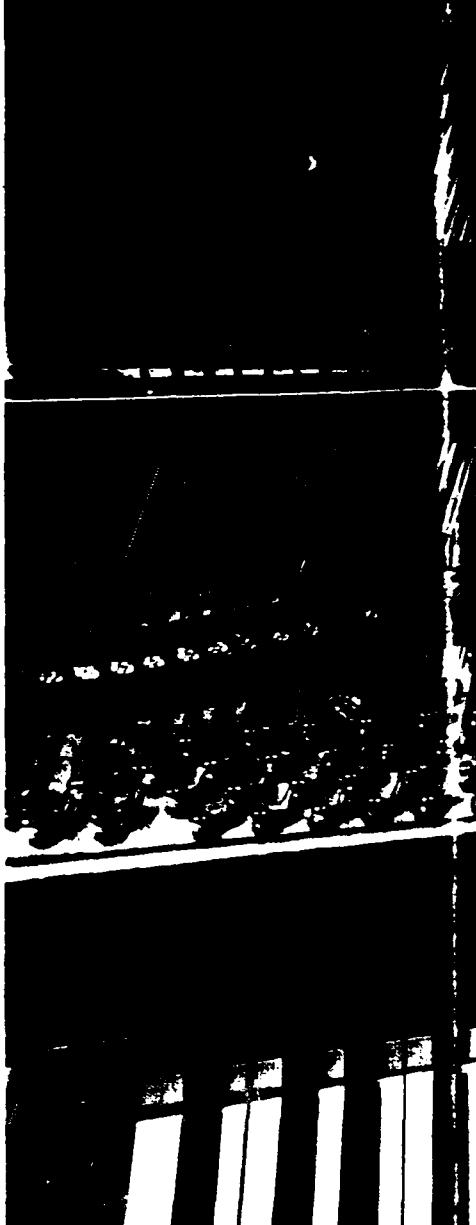
- explaining the need for improvement as well as its individual and collective benefits;
- communicating the organization's strategic quality goals;
- developing a common language to talk about quality-related issues;
- defining the structure and process through which quality improvement will take place;
- clarifying everyone's responsibilities;
- providing people with tools and techniques to manage the quality of their work.

Like launching any major training effort, starting a quality-improvement

is small or has limited in-house training resources and expertise. You may want to send your people to classes at the consultant's facilities or have the consultant come to you. Get off to a good start with a proven package and consultant group, to provide the support you will need.

Even if you have the resources to design your own programs in-house, you should get the assistance of a proven expert. Developing a comprehensive training-for-quality curriculum is a complex, time-consuming job that requires specialized knowledge and experience. Successful training-for-quality efforts usually begin by picking a consultant or training supplier whose approach is compatible with management's philosophy and who has the training materials needed to begin quickly. But the culture of each organization is different, so be sure that the group you work with will customize its approach to your unique requirements.

Budget and Resources

Training for quality is an expensive, time-consuming business. Anyone who thinks it can be done cheaply or quickly is in for a big disappointment. Once you have familiarized yourself with the cost of training-for-quality materials and decided with management on the most appropriate implementation strategy, you need to develop the budget to get the training done. That's one of the first tests of management's real commitment to pursuing meaningful quality improvement. Experts and experienced practitioners agree that extensive, ongoing training is needed throughout the organization to achieve lasting improvement. Management must be willing to make an investment in training up front in order to reap the rewards improved quality will bring.

When it comes to training for quality, the return on that investment can come quickly. Joseph Juran has compiled numerous examples from different industries of cost-benefit analyses of training. He concludes that in a typical company with $1 billion in revenues, the average savings per quality-improvement project exceeds $100,000 a year. With an average initial investment in training for the project team ranging from $5,000 to $20,000, the average company will see a staggering five to 20 times payback in the first year alone. Additional benefits of

everyone in the organization. Organizations that have tried improving quality from the bottom up—for instance, by training only quality-circle members—have had disappointing experiences. But internal trainers often have difficulty training the executive group. Internal staff frequently does not have the credibility or needed perspective that is essential for executive development. The safest route is to employ the services of an outside expert who has name recognition and the respect of your senior staff.

When using the top-down approach, you should stagger the training between levels to allow it to sink in and have its effect. Give senior managers time to start applying the concepts and techniques before you start training their subordinates. They must create the vision, develop the structure, and set the tone for the entire improvement effort. Leadership by example is always more powerful than words of support and verbal commitments. Apply that approach to each layer of your organization. Don't rush into training individual contributors before it's clear that their managers and supervisors are securely on board with the concepts.

Another consideration in your

strategy is whether to train the entire organization in stages, or to approach training on a department-by-department or project-by-project basis. Certainly, training the whole organization, level by level, is logical. That approach gets everyone knowledgeable at the same time and talking the same language. On the other hand, it is frequently safer to work initially with departments or project groups who already want your assistance and can serve as positive role models for the rest of the organization. Working with "quality champions" will guarantee you the support you need to begin successfully, and can provide the kind of testimonials that get other people's attention. And, it is often easier to obtain the needed budget and resources once you have demonstrated the value of your training. Both approaches have been shown to be successful, so pick the one that will work best in your situation.

To Make or To Buy

Once you are familiar with what's available in the marketplace, you will be faced with a make-or-buy decision. Your best bet is to go with a packaged program that seems to meet your needs, especially if your organization

improved quality—increased productivity, market share, and profitability—are even greater

How do you budget the training dollars? Some organizations centralize the costs in the training department's budget so that they can be closely controlled. Some choose to decentralize the training expenditures in the budgets of the operating departments. A centralized budget gives you more control over how and when training is done. but the large aggregate number may scare your management. Departmental budgeting makes the costs less visible and usually gives the departments a greater feeling of "ownership" of the training

Who Should Do the Training?

When it comes to conducting the actual training, you have three resources: training department staff, line managers, and outside consultants. For most companies, the most effective approach uses a combination of all three

As mentioned earlier, it is usually best to have a recognized expert conduct the executive sessions. The sessions should be held off-site to minimize the chance of interruption. When it comes to training middle managers and first-level supervisors, you have more flexibility. In small organizations it may be cost-effective to use external resources exclusively or in combination with training department staff. In larger organizations, the most successful training-for-quality programs use line managers as trainers.

Training line managers to serve as trainers has the following advantages over using consultants and training department staff:

■ They greatly expand your delivery capabilities and allow training for quality to take place more rapidly.
■ They can often be more effective trainers because of their ability to readily apply the concepts of quality improvements to company-specific problems and opportunities.
■ The quality message has more impact when people hear it from the boss.
■ Managers learn more about quality by teaching it, and gain more "ownership" for the training and the entire quality-improvement process.

Your training expertise can really pay off in developing the instructional skills of line managers. Have them attend the various training-for-quality

programs and then a train-the-trainer workshop. The train-the-trainer program should be specifically geared to the requirements of training for quality improvement. The certified line managers then become members of the organization's "quality-improvement faculty," adding prestige and visibility to the function.

Training for quality cannot stop with

managers and supervisors. but must be extended to the individual contributor level to become effective. At that level, you should train your first-level supervisors as trainers and charter them with providing their people with the knowledge and skills they need to fulfill their quality-improvement responsibilities. Like any major change in direction. quality improvement that doesn't

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Before you start designing your training-for-quality programs, it is important to understand your organization's readiness to undertake such a massive change effort. Answering the following questions should help clarify the issues that will be critical to the success of your training.

Questions for management

■ How committed is your top management to quality improvement? Is quality merely another management fad that will come and go?
■ Does the organization have an overall quality-improvement strategy? Does the strategy involve the entire organization and does it acknowledge the need for continuous improvement over a long period of time?
■ To what extent does management have a common understanding about what constitutes quality in your business? Is customer orientation an important value that is communicated by management?
■ What happens when management is forced to make trade-offs between costs, schedules, and quality? Can you give examples of situations in which management made difficult business decisions in favor of quality?
■ Do the incentive systems reward people for contributions to quality improvement? Are people rewarded by management because of their demonstrated competencies and capability to quality improvement?
■ Is the management environment open to input from

employees? Are people afraid to speak their minds and make suggestions for improvement? Do they believe management really cares about their ideas and concerns?

Questions for the training department

■ How important is training considered to be in the quality-improvement effort? Is the training department involved in planning the overall quality-improvement strategy?
■ How much credibility does the training department have with line management? Have you been involved in providing other training with such direct operational implications?
■ What are the capabilities of the training department to develop and initiate training-for-quality programs? Do you have the senior talent necessary to undertake a training-for-quality program?
■ How receptive will people be to the training-for-quality programs you will offer? Will you have to overcome resistance and skepticism?
■ Do you have a good profile of managers' and employees' skills in relation to quality-improvement requirements?
■ Are programs already offered that could be tied into a larger quality-improvement curriculum? What skills have you taught that you can build on in your training?
■ What level of resources will be made available to developing the training? Can you afford to hire experienced consultants to get the process underway? Can you form partnerships with operating departments to share the costs?

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come directly from the supervisor is likely to have little effect.

The Trainer's Many Hats

As we have just seen, the roles of the trainer in the quality process are many. To effectively manage the training-for-quality program you need to be comfortable moving from role to role as needed. (For more information about trainers' roles, see the ASTD Competency Study.) The following roles are important:

■ **Researcher and needs analyst.** The trainer must be a knowledgeable resource and consultant to management. You should be able to advise management about available training options and which would be the most likely to succeed. You can also play the important role of analyzing individual and group performance discrepancies and their causes.

■ **Organization change agent.** The trainer can help influence management's decision-making process toward results that are in the organization's best interests. Achieving lasting improvements in quality requires significant changes in the culture of the organization. Quality improvement is a major organization-development intervention. As such, it needs guidance and direction from someone who understands the issues involved with bringing about organizational change.

■ **Designer.** The trainer can fill the role of architect of the training-for-quality curriculum, putting together the model and strategy that will best serve the organization. It is probably the most critical role, and one that must be shared with the executive group. You also serve as a liaison, putting management together with external training resources that will be needed. In that role, you need to develop mutually supportive relationships with your external consultants and help them be successful in the organization. Teamwork is essential.

■ **Materials developer and evaluator.** As discussed earlier, you may want to gain experience with training for quality before venturing into developing your own materials. Start by working closely with the consultant or supplier to tailor the presentation of their materials to the specific needs of your organization. Then, evaluate the effectiveness of the training and determine the extent to which you need to further customize the materials.

■ **Instructor/facilitator.** When it comes to training for quality, the most important use of your primary function as an instructor will probably be in helping others take responsibility for conducting much of the actual training. Also apply your group-facilitation skills after training, when people throughout the organization attempt to use the new quality-improvement techniques for the first time.

A Leverage Point for Training

Clearly, many of the skills needed for quality improvement are not unique to quality. Many are the same basic management and supervisory skills that you probably already teach in your other courses: goal setting, problem solving, meeting management, giving and eliciting feedback, delegating

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Achieving lasting improvements in quality requires significant changes in the culture of the organization

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responsibility, participative management, giving recognition, and so on. Build on the skills you already teach and demonstrate the relevance of your existing curriculum to the quality-improvement process.

You should also take advantage of the big push behind quality to promote your training. Many trainers find that quality can be a leverage point for the entire training activity. Many skills taught in management and supervisory classes are seen by participants as nice to have, but not essential to their success in business. Those skills lack the broader business context that would help managers understand their relevance. But quality improvement can serve as the unifying concept for your entire curriculum. When skills are viewed in the context of quality improvement, they suddenly take on greater perceived value. So take advantage of the opportunity quality provides to give your training greater leverage throughout the organization.

Training-for-quality curriculum

Everyone in the organization requires training in order to understand the need for quality improvement, let

them know their roles in the effort, and show them how to go about the process. Training for all employees needs to be consistent in terms of your organization's quality philosophy, approach, and terminology. Training should also be tailored to the specific responsibilities people will have in the improvement process. This curriculum outline addresses the major features of the initial training-for-quality programs needed to launch the quality-improvement process at each level of the organization. Additional training should be made available to people on an ongoing basis, based on their responsibilities, specific disciplines, and individual learning needs.

Upper Management

Length: two to three days.

Approach: The upper-management workshop should be an off-site retreat conducted like a strategic planning meeting. Educational aspects of the retreat should provide the context for quality-improvement planning and decision making. Use a variety of facilitation techniques to minimize formal presentations and maximize participant interaction. The pace should be challenging and participants should be kept active. Tangible outcomes, such as plans and decisions, should occur frequently throughout the session.

Objective: At the end of the workshop, upper managers should be prepared to initiate the quality-improvement process and begin creating an environment that supports continuous improvement.

Subjects:

■ What quality is and what it means for the business. Focus on defining quality; global competition and rising customer expectations; and the relationship of quality to important business indicators such as costs, productivity, market share, and return on investment.

■ Customer orientation and service.

■ Defining customers' requirements and expectations.

■ Assessing quality position relative to competitors.

■ Identifying strategic quality goals

■ Treating suppliers as strategic business partners.

■ Applying the poor-quality cost model, in terms of prevention, appraisal, and internal and external errors

■ Adopting a continuous-improvement philosophy, encompassing such

ideas as "fixing it even if it ain't broke," shifting resources from "fire-fighting" to improvement, and viewing improvement as a way of life.

■ Roles of top management in quality improvement, such as communicating a compelling vision of the future, determining and communicating strategic quality goals; developing policies, structure, and process for quality improvement; creating a work environment that encourages participation and improvement; revising incentive systems to reward quality improvement; and eliminating structural and inter-organizational barriers to quality improvement.

■ Developing a structured approach. That could comprise quality improvement as a cultural change process; shifting to a prevention mode; defining and implementing the quality-improvement process (including procedures for planning, implementing, monitoring, and evaluating improvement activities); creating organizational structures for quality improvement; managing with quantitative methods; ensuring feedback and taking corrective action; and training for quality.

■ Planning to implement the quality-improvement process, with steps such as defining objectives, schedules, and milestones for the organization; defining individual roles and creating action plans; developing a plan to communicate the quality-improvement strategy and process to the organization; and anticipating barriers to quality improvement.

Middle Management

Length three to five days

Approach The middle-management workshop can be conducted off-site or on company premises, in a single session or broken into separate modules. The one-session, immersion approach builds enthusiasm and camaraderie, because it allows participants to concentrate on the subject of quality uninterrupted for an extended period of time. The modular approach ensures a better transfer of knowledge from the classroom to the job by allowing participants to apply specific concepts at work before going on to the next subject (See the figure, "Modular Instructional Design").

Objective At the end of the workshop, middle managers should be prepared to implement the quality-improvement process in their organizations.

Subjects:
■ Defining quality.
■ Why quality is critical to continued business success.
■ Customer orientation and service.
■ Identifying internal customers and defining their requirements.
■ Assessing departmental quality.
■ Applying the poor-quality cost model to departmental activities. That includes preventing errors, finding errors, and fixing internal and external errors.
■ The meaning of a continuous-improvement philosophy.
■ Roles of middle management in quality improvement, including communicating the quality philosophy and strategic goals, organizing and managing the improvement process, deploying the quality policy, managing organizational change, setting priorities for improvement efforts in different areas, participating in quality-improvement project teams, eliminating barriers to improvement, encouraging employee participation and commitment, supporting first-level supervisors, developing quality standards and measurements, and training supervisors for quality.
■ Developing departmental quality goals, with emphasis on translating organization-wide goals and

Modular instructional design		
Pre-Session	Pre-work Exercise	■ readings ■ assessment instruments ■ data gathering
Session Activities	Debriefing of Assignment	■ review of last session ■ report of findings ■ discussion of results
	Instructional Objectives	■ presentation of session objectives
	Discussion of Pre-work	■ small and large group discussions of pre-work assignment
	Presentation of Concepts	■ video, slides, charts ■ instructor presentation
	Application Exercise	■ skill practices, role plays ■ case studies ■ experiential exercise
	Debriefing	■ group discussion of exercise
	Session Summary	■ summary of learnings ■ discussion of barriers to implementation
	Action Planning	■ individual/group planning for implementing skills on the job
Post-Session	Homework Assignment	■ apply to work ■ implement step in quality-improvement process ■ gather data ■ identify/analyze problem ■ train others

identifying quality-improvement opportunities.

■ Creating an improvement-oriented environment. That can be achieved by encouraging people to take responsibility for improving quality, maintaining open communications, eliciting input and suggestions, acting on people's improvement ideas, allowing people to make mistakes and learn from them, and rewarding individual and group quality-improvement progress.

■ Developing partnerships with suppliers by reducing the number of suppliers, developing trust and making mutual commitments, sharing information and resources, communicating requirements, implementing process controls and eliminating inspection, providing feedback and taking corrective action, and supporting suppliers' quality-improvement efforts.

■ Managing with quantitative methods. Stress the importance of quantifying work processes, working for prevention through process control, using tools and techniques for data gathering and analysis, applying specific techniques, and encouraging others to use quantitative methods.

■ Implementing a structured approach to quality improvement that includes viewing quality improvement as a cultural change process; shifting to a prevention mode; communicating about quality improvement to supervisors and individual contributors; creating a departmental quality-improvement structure; putting in place procedures for planning, implementing, monitoring, and evaluating quality-improvement activities; setting up and managing quality-improvement projects; ensuring feedback and taking corrective action; and training for quality.

■ Action planning to implement the quality-improvement process, including defining departmental objectives, schedules, and milestones; anticipating barriers to quality improvement; and developing a training-for-quality plan and schedule.

First-Level Supervisors

Length: 10 four-hour modules.

Approach: The workshop for first-level supervisors is usually held on company premises because it is typically modular in format. Individual sessions last from two to four hours in length. The modular approach ensures that knowledge is effectively transferred from the classroom to the job by

allowing participants to apply specific concepts at work before going on to the next subject.

Objective: At the end of the workshop, supervisors should be prepared to carry out quality-improvement projects in their areas of responsibility.

Subjects:

■ What quality is and why it is critical to continued business success.

■ Customer orientation and service.

■ Identifying internal customers and defining their requirements.

■ Why it is more efficient to prevent errors than find and fix them.

■ Quality standards and measurements.

■ Roles of first-level supervisors in quality improvement, including reinforcing quality philosophy and goals, identifying opportunities for operational or process improvement, organizing quality-improvement projects

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The modular approach ensures that knowledge is effectively transferred from the classroom to the job

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and employee-involvement teams, supporting people through the change process, leading employee-involvement teams, serving as resources to employees to eliminate barriers to improved performance, and training employees for quality improvement.

■ Supporting an improvement-oriented environment by maintaining open communications, eliciting input and suggestions, using participative management techniques, acting on people's improvement ideas, aligning employee needs with those of the organization, helping people learn from their mistakes, providing constructive feedback for improvement, and encouraging people to take responsibility for improving quality.

■ Working effectively with suppliers by communicating schedules and requirements and providing feedback and recommending corrective action.

■ Importance of quantitative methods. Focus on quantifying work processes and prevention through process control.

■ Tools and techniques for gathering and analyzing data, such as brainstorming, checksheets, graphs, scatter diagrams, cause-and-effect diagrams, histograms, Pareto diagrams, and control charts.

■ Action planning to implement the quality-improvement process, including defining opportunities for immediate improvement, anticipating barriers to change, preparing to train for quality, and planning to organize employee-involvement groups.

Individual Contributors

Length: 10 two-hour modules.

Approach: The sessions for individual contributors are held on company premises and are modular in format. Individual sessions are normally limited to two hours. The modular approach ensures maximum transfer of knowledge and minimizes disruption of the workday.

Objective: At the conclusion of the workshop, individual contributors should be able to participate as members of employee-involvement teams and apply the tools and techniques to make continuous improvements in their work.

Subjects:

■ What quality is, why it is important, and how it is measured.

■ The importance of customer orientation and service.

■ Why it is more efficient to prevent errors than find and fix them.

■ Working in a continuous-improvement environment.

■ How the quality-improvement process works.

■ Roles of individual contributors in quality improvement, such as identifying areas for quality improvement, communicating problems to management, working to continuously improve work processes, participating in employee-involvement teams, and working cooperatively for the betterment of the organization.

■ Working effectively with suppliers

■ Importance of quantitative methods. Focus on quantifying work processes and prevention through process control.

■ Tools and techniques for gathering and analyzing data, including brainstorming, checksheets, graphs, scatter diagrams, cause-and-effect diagrams, histograms, Pareto diagrams, and control charts.

■ Action planning to implement the quality-improvement process by joining an employee-involvement team, identifying potential opportunities for immediate improvement, preparing to use the tools and techniques, and anticipating barriers to improvement

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Team Up For Quality Improvement

John Persico, Jr.
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Team Up for Quality Improvement

Process improvement teams approach problems from a different direction.

by
John Persico Jr.

T EAM INVOLVE-
ment is an integral part of quality improvement. Quality experts all emphasize the importance of teams in a total quality improvement process. W. Edwards Deming said, "Teamwork is sorely needed throughout the company."[1] J.P. Davidson, writing in *Management World* magazine. reported the following benefits from employees working in teams:

• Group performance is increased.

• Poor alternatives or decisions are more likely to be avoided.

• New ideas are identified.

• Enthusiasm is generated.

• Mission and objectives are re-emphasized.[2]

Drawing on the lessons learned from experience in many organizations, a concept of quality improvement has been developed that emphasizes the critical role of teamwork. The ideas underlying the structure and operation of these quality improvement teams, called process improvement teams, differs in many respects from other team approaches.

Traditional quality efforts have been focused on finding nonconformities after they were produced.[3] The main goal of process improvement teams is to identify and continuously improve critical process variables that influence key quality indicators. Process improvement teams should prevent nonconformances and improve processes, not merely detect nonconformances or perform random problem solving.

Most theories of organizational behavior have recognized the importance of work teams in quality improvement. Unfortunately, the traditional team model (as exemplified in American quality circle efforts) believes in myths. The following three myths are perhaps the most problematic in participative management approaches:

• Workers are fully capable of identifying and directing quality improvement efforts. Without the interference of management, employee work teams can improve productivity and decrease costs.

• A happy, harmonious, motivated wo·k team is an effective work team. Team-building and communication-skills training ensure an effective work team.

• Most experienced employees have the needed skills, knowledge, and technical expertise to identify and successfully resolve major organization and systems problems.

In contrast to these beliefs are four major premises that provide the theoretical basis for the process improvement team concept:

1. Ongoing management involvement and leadership are essential for the effective performance of work teams. Management must empower teams. provide key resources, select and train personnel. and help identify key processes for improvement efforts.

2. Work teams are sociotechnical systems. A team requires a sound infrastructure to function effectively. This infrastructure is based on an explicit set of guidelines and ground rules that provides direction and focus for the completion of all tasks related to the team's mission and purpose. Relationship training, communication skills training. and other human relations training must be based on actual work objectives. If this is not done, such training will be viewed as academic, irrelevant, and probably ineffective.

3. A work team needs effective team leadership The most effective comes from a successful

Team Up for Quality Improvement cont.

blending of the diverse skills and personalities of all team members. The designated team leader should have ultimate responsibility for the team. Nevertheless, such leaders must recognize that only by drawing on the diverse talents, abilities, and ideas of all team members will they create a highly effective team. Leaders cannot be autocrats.

4. Team members need skills training in process analysis, statistical process control, and unstructured problem solving. Team members should not be expected to produce continuous improvement in processes and products without the skills to do so.

Establishing the foundation

Management commitment and support must start with building a structure within the organization that will not only support team efforts, but will create a total quality organization. Top management must understand the need for improvement and must take an active role. Training must be thorough and ongoing. Positive rewards for success must exist.

These factors provide the foundation for a successful team effort. Unless management is willing to make a commitment to these efforts, teams are likely to perceive their role in the process as futile.

If an organization is going to change from old-style management to creative leadership, it must establish a structure within the organization that will drive the process. This structure is responsible for diffusing authority for innovation, for continually retraining employees to handle more complex tasks, and for taking seriously labor's need for increased job security.

The structure that is created must promote certain values and attitudes. It must create a vision for change. William W. George stated the following seven values as critical for the success of an organization:

* an atmosphere of openness and trust.
* willingness of all employees, including management, to interact on an equal basis.
* acceptance of change as a way of life.
* cooperation between departments.
* willing individuals.
* a strong, ongoing organization program.
* growth in the organization.[4]

Deming suggested 14 integrated principles that an organization must follow if it is to be successful. His 14 points provide one of the most comprehensive visions for change available to organizations today. An organization involved in a quality improvement transformation must develop an infrastructure that is guided by a vision of what could be. This structure must take an active role in identifying and removing barriers to improvement.

Preaching is not enough

It is no longer enough for managers to preach a philosophy of commitment to quality improvement. The change to a total quality organization requires that managers take an active involvement in the change effort. Managers can demonstrate their involvement by playing a key role in all quality improvement efforts. To play such a role, managers must be trained to use the same tools as all workers and must take an active role in helping employees to improve processes.

Bob Crosby identified the need to train middle management as one of 12 key steps in a successful employee involvement effort.[5] He said that top management must do more than just arrange for training for these managers. They must also "make it very clear that they are rewarding their middle managers and their

first-line supervisors primarily for their ability to use the resources of the people they supervise." With process improvement teams, all managers receive training in team effectiveness and statistical process control. Supervisors and foremen conduct training with their employees in the techniques they have learned. Process improvement teams ensure that all managers are competent with the seven major statistical tools. This sends a loud message that management is actively involved in the effort.

Management must also actively participate in managing the quality improvement effort. One way managers can do this is by working with hourly employees to identify critical processes for improvement. Ronald D. Moen describes a strategy for process improvement in which the first step is to identify those processes that have the greatest effect on customer satisfaction. The insights of managers and supervisors are needed in this effort. They should not supplant the initiatives or ideas of employees, but they can and should complement them. Management's active involvement establishes the credibility of the improvement effort and ensures that workers will have the needed support and resources to make changes.

The proper training of all personnel involved in the quality improvement process is essential to the success of the effort. Teams need to address both task and process issues. Process improvement teams address the issue of task and knowledge development through the systematic training of all team members in statistical process control (SPC).

Experience has shown that training for process improvement teams is most effective when delivered just-in-time. Training received too early in the effort is often perceived as meaningless and irrelevant. When begun during a team's formative stage, such training has not been well received. It is not unusual for new teams to ask for team effectiveness training when they know other teams have received it. However, it is critical that managers realize that the development of their human resources must include a plan for continuous improvement. It is naive to assume that the development of human resources can be effectively achieved through the one-shot application of any training, regardless of its initial effectiveness.

Positive rewards

The importance of positive recognition would seem to be so basic that very little could be added to it. Nevertheless, U.S. firms spend millions of dollars in often futile searches for more effective ways to reward and recognize employees. Despite the enormous expenditure of cash in an effort to "buy" employee loyalty and commitment, the evidence suggests the opposite results. Pat Choate of TRW reported a study of employee attitudes that sought to determine whether they felt they would benefit from quality and productivity increases in their company. Only nine of 100 hourly employees in the United States felt they would benefit from improvements. The same study in Japan showed that 93 out of 100 workers felt they would directly benefit from increases in quality and productivity.[6]

There are four basic problems in most systems developed for rewarding or recognizing employee contributions. First, and perhaps most serious, is the view that such rewards can offset the need or desire for job security. One theory as to why the Japanese more readily accept the introduction of labor-saving technology is the relatively higher levels of job security in Japanese industry. It would seem that employee incentives cannot be a substitute for good labor relations practices.

A second mistake managers make is to assume that financial recognition is an adequate substitute for employee recognition or other forms of intrinsic needs that employees report. All too of-

Even though American industry has made a heavy investment in new management approaches, many efforts don't make the most of available resources. Some reasons for their failure can be seen by looking more closely at two well-known and often-used approaches: quality circles and problem-solving teams.

The *National Productivity Review* has reported that seven U.S. quality circles fail for every one that succeeds. Despite the widespread belief that the success of quality circles in Japan was a result of cultural differences, W. Edwards Deming said that American management has grossly misunderstood the purpose of quality circles. In *Quality, Productivity, and Competitive Position,* Deming wrote, "Most QC-circles in America are, I fear, management's hope for a lazy way out, management in desperation."

One of the more fundamental problems with the implementation of quality circles has been the unwillingness of middle managers and first-line supervisors to involve themselves in setting a direction for quality circle activities. This failure can be traced to the expectations that top management had for the quality circle program. Top management often set the expectation that circles were the responsibility of hourly employees and were merely a way for them to address a disparate range of quality of work life issues. In Japan, circle activities are an integral part of management's responsibility. Projects are guided by the experience and needs of the organization.

A second major problem with the organization of U.S. quality circles has been the failure of American management to differentiate between management's responsibilities and workers' responsibilities.

Problem-solving teams are generally based on the quality circle approach and have many of the same shortcomings. Nevertheless, there are some differences. The typical quality circle approach of forming the team first and then deciding on the problem is reversed, with a steering committee seeking problems then recruiting team members.

A problem with this approach is the lack of integration between the efforts of the steering committee and the entire organization's quality improvement needs. A total quality improvement process cannot abstract problems and attempt to deal with them without making major changes in the overall structure of the organization.

A second weakness with problem-solving teams is evident by the very title chosen for the teams. Problem solving suggests identifying nonconformances and then finding some way to fix or repair them. Such approaches to quality improvement focus on special causes while ignoring the system that produces these causes. Furthermore, this strategy does little or nothing to perpetuate the concept of continuous improvement.

ten, companies make the mistake of assuming that giving employees more money will be seen as a satisfactory substitute for praise, recognition, or merely feeling a part of the company. Some research suggests that employers may get more for their money through noncash incentives.[7] Other evidence indicates that the results of financial incentive schemes on performance might be considerably weaker than was previously assumed.[8]

The third problem with many reward or recognition systems in organizations is that they fail to acknowledge normal process variance. Employees are often rewarded for performance or results over which they have little or no control. Deming has said that such systems are lotteries. Employees see little or no connection between their actual work effort and the results. Failing to establish this connection reduces many rewards to in-house jokes. In one company, employees joked about whose turn it was to be employee of the month.

Finally, most reward systems fail to reward efforts as well as results. If only results are rewarded then innovations and ideas that cannot bring quick results or might not ever bring results will be discouraged. Because many projects in an organization cannot be guaranteed to be successful, only recognizing results will ensure an adequate link between the goals of individuals, teams, and the organization.

Putting the process improvement team together

The model developed for starting a process improvement team was based on a review of the literature concerning team development. Further refinement of this model has come about through a series of trial-and-error tests. The model was piloted by work teams at all levels in several different organizations. Thus the process improvement team model represents a blending of theory, research, and empirical development.

The major purpose of the team effectiveness training for a new process development team is to help lay the foundation for a successful team effort. Certain prerequisites are assumed to be in place before a team is launched. It is expected that all team members have had SPC training. It is also expected that a sound organizational structure exists to support the team effort.

The process by which the team is established is key to the team's later efforts. The nature of the task to be accomplished should also be an important consideration in the selection of team members. It is expected that the nature of the task will affect the people identified for the team.

Three task or process factors are related to three personnel factors. The three task factors are complexity of the process, scope of commitment required for changes to occur, and magnitude of the resources required. The three personnel factors are level of management with immediate authority or responsibility for the process, functional areas involved or affected by the process, and perspectives, expertise, or ideas needed to improve the process.

Each of the characteristics of the process or task must be reviewed to determine who should be on the team. Thus, a simple process might only require a team composed of a supervisor and two or three immediate subordinates. A complex process involving numerous departments or functional areas and necessitating substantial logistical support might include two or three levels

of management, personnel from several areas, and outside experts. The major limiting factor for any team is the inherent complexity as the number of team members increases. This complexity increases factorially for each new member. Thus, it is wise to keep each team as small as possible.

While the nature of the task should be a major factor in the selection of personnel, it is equally important to respect the integrity of the intended team members. There is little that is more detrimental to a team effort than the assignment of unwilling "volunteers." All efforts should be made to ensure that participants want to contribute.

Team effectiveness training helps ensure that team members have the necessary skills to handle team processes. Such training must also reduce variability in a team. When there is a wide range of management levels or skills in the team, the training helps reduce this variability and helps ensure that all members have the

> # M
> ost reward systems fail to reward efforts as well as results.

chance to contribute. On process improvement teams, members facilitate and deal with issues that arise in the normal conduct of business. In this model, each team member contributes some of the essential elements needed for effective shared team leadership.

The process improvement team model assumes that all members can contribute to the team process and that, given the chance, they will develop even more effective team process skills. The actual team training is based on a six-step process improvement model that addresses both task and process functions necessary for team effectiveness.

1. Develop and clarify a team mission. One of the most important tasks for a new team is to identify its primary mission and objectives. Mission statements need not be encyclopedic. A primary goal of this effort is to ensure that team members develop ownership of the identified mission. A secondary goal is to ensure that all team members understand the tasks that need to be accomplished.

2. Establish ground rules for team activities. Every group of individuals that comes together brings a set of expectations of how to behave. Experience has shown that unless these underlying expectations and assumptions are addressed, they will later affect the group's effectiveness. A simple task intervention is used to address this problem. The first part is to help the team learn expectations and to make these expectations explicit through a set of well-discussed and defined team rules.

The second part of the intervention is to address the group's norm for decision making. The process improvement team model calls for a discussion of the basic strengths and weaknesses of four decision-making styles: autocratic, autocratic with input, democratic, and consensual. All team members are then asked to select their primary decision-making process.

3. Traditional management literature describes the need for translating a mission statement into a concrete agenda. The Japanese have honed this to a fine art through the use of a strategy they call policy deployment. Masaaki Imai defined policy deploy-

ment as a process for "internalizing policies for kaizen (continuous improvement) throughout the company, from highest to lowest level . . . In Japan, the term policy describes both annual and medium- to long-range targets or orientations."[9] The concepts involved in policy deployment have greater applicability for top and middle management, at least in the initial stages of a quality improvement effort. Thus the initial team training does not go into more than a cursory explanation of this concept.

A planning pyramid developed by M.H. Mescon, M. Albert, and F. Khedouri was adapted as a visual device to help team members understand the link between mission, objectives, and action plans.[10] Team members are then asked to take the mission statement that they have developed and to arrange their next meetings around the task of establishing long-, medium-, and short-range objectives. Usually, there is not enough time for this in the initial meeting.

4. Identify roles and responsibilities for team members. Team members are taught the concept of a functional role and responsibility matrix to help them understand the need to allocate and divide responsibilities. Team members are not expected to have rigid role definitions. Rather, it is encouraged that roles and responsibilities be fluid and negotiable. Team members are left with the ability to structure and allocate work assignments that must be accomplished between team meetings.

5. The process of quality improvement. Quality improvement within the context of team effectiveness training refers to the process model that is taught during process improvement leader training. This is a model that specifies a set of procedures for the application of SPC techniques. These techniques can be used for problem solving or process improvement. M. Nash has identified six steps in a linear sequence of process improvement:
- Identify the customers and their requirements.
- Define the current process to meet their needs.
- Determine the problems in the process.
- Analyze the problems using SPC tools.
- Improve the process.
- Monitor and plan for continuous improvement.[11]

All team members are expected to have received complete SPC training. Most training will have been conducted in-house by specially trained company personnel. There are many advantages of SPC over other problem-solving or process-improvement methods. Some of the more obvious advantages are the ability to verify, repeat, and reproduce data-based measurements; to separate assignable causes of quality variation; and to determine the past, present, and (to some degree) future status of a process.

Among the less obvious advantages of SPC training is that such training creates a common language for all team members. Because the language of SPC is based on objective, quantifiable data, team members are prepared to discuss facts based on hard data rather than opinions or personal preferences. This helps create an atmosphere of trust since there is little opportunity for arguments or hidden agendas.

6. Evaluate the group process. No effort or team can be improved unless it is willing to periodically evaluate its processes. The concepts of continuous improvement are related to how teams function and manage their internal activities. Team members are encouraged to use a simple questionnaire or develop their own questionnaire that they can use to periodically assess team effectiveness. The evaluation consists of an assessment of both the task and personnel processes that are necessary for an effective team. Team members complete the assessment anonymously and then assign someone to summarize the results. A future meeting is set aside to discuss the feedback and look for ways to overcome areas that are perceived to cause problems.

America cannot afford old-style management

Teams are an important element in an overall quality improvement strategy. If properly managed, teams bring together individuals with expertise and perspectives that are critical to process improvement. The days when a small, elite group of managers can be assumed to have a monopoly on the brain power needed to effectively manage an organization are over. American firms cannot afford to continue to practice old-style management—a style and system that unfortunately is still taught in universities throughout the country.

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3-4

A Total Quality Management Process Improvement Model

Steven L. Dockstader and Archester Houston
Navy Personnel Research and Development Center
1988

The following is a summary of Technical Report 89-3, *A Total Quality Management Process Improvement Model.* Copies can be obtained by contacting Navy Personnel Research & Development Center, Code 16, San Diego, California 92152-6800; (619) 553-7951 or A/V 553-7951.

SUMMARY

In an effort to improve quality and productivity, Navy industrial organizations are adopting a management approach known as total quality management (TQM). This approach is based on a set of management practices and statistical measures that, when combined, can remove the causes of poor product quality and excessive cost.

The management practices and analytic methods adopted by the Navy's aviation maintenance organizations are based primarily on the TQM concepts of W. E. Deming. Some of the critical concepts are:

• Quality is defined by customers' requirements.

• Top management has direct responsibility for quality improvement.

• Increased quality comes from systematic analysis and improvement of work processes.

• Quality improvement is a continuous effort and conducted throughout the organization.

The TQM approach emphasizes the major role that managers have in achieving quality and productivity improvement for an organization. Deming and other TQM proponents, such as Crosby and Juran, estimate that up to 85 percent of quality improvement is under direct control of management and can not be remedied by the hourly employee or staff member.

Under the TQM approach, managers are expected to achieve quality improvements through the use of a process improvement approach known as a "Plan-Do-Check-Act" cycle. This approach was originally associated with the analytic work of Shewhart, a colleague of Deming.

This report describes an approach to integrating the procedures of process improvement with an organization made up of cross-functional teams. Specifically, the report describes how the "Plan-Do-Check-Act" cycle described by Shewhart and Deming has been adapted for use by Navy organizations.

Deming advocates teamwork, particularly across functional groups. He emphasizes two-way communication to identify sources of quality problems and to reduce fear of change and loss of job security. Combining these concepts with those of others such as Ishikawa and Lu as well as Ackoff concerning cross-functional groups, Navy aviation maintenance organizations adopted an organizational structure to complement the TQM approach in their organizations.

The structure is composed of hierarchically linked, cross-functional teams called Quality Management Boards or QMBs. Each board contains a group of managers who are principally responsible for a process that was targeted by top management for improvement. A QMB also includes a member from senior management, as well as one or more subordinate-level managers or staff with process expertise. Thus, each board is made up of three levels to increase vertical communication and several functional departments to increase horizontal communication.

Process improvement using the "Plan-Do-Check-Act" cycle requires two kinds of improvements: (1) those that address the occasional and unpredictable problems that occur in a system, referred as "special causes of variation" by Deming and others; and (2) those concerned with the system itself. The latter are referred to by the experts as "systems causes" or "common causes of variation." In order for management to improve the system, it must first establish system stability by removing the special causes. Because this activity depends upon "real time" interventions in the process, the QMBs must establish teams of workers, called "Process Action Teams," to work on the various phases in the process.

The fundamental purpose of this report is to provide a detailed description of the roles and activities of the QMBs and the Process Action Teams in the context of the "Plan-Do-Check-Act" cycle. Clarification and differentiation of these roles are necessary for effective process improvement.

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The Application of Quality Management Principles In Industrial Research and Development

Myron Tribus

American Quality and Productivity Institute

1988

THE APPLICATION OF

QUALITY MANAGEMENT

PRINCIPLES IN

INDUSTRIAL RESEARCH AND

DEVELOPMENT

BY

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INTRODUCTION

The quality of Industrial Research and Development (R&D) should be judged in the context of industry, not academia. Industrial research should produce the ideas and knowledge which enable the development of new or improved products and processes which lead to commercial success. Industrial R&D should provide its sponsors with future industrial competitiveness.

R&D is but one link in a chain of activities required to keep an organization in the race. Success requires every link in the chain to be strong. Success depends upon the coordination of many elements; the R&D activities cannot be judged in isolation. Engineering, manufacturing, selling maintaining, distributing and warranting must also be properly carried out. The entire process requires skillful management.

Research. Development and Engineering have their own special functions:

THE FUNCTION OF RESEARCH IS TO PRODUCE USEFUL SURPRISES.

THE FUNCTION OF ENGINEERING IS TO PRODUCE NO SURPRISES.

THE FUNCTION OF DEVELOPMENT IS TO TAME SURPRISING RESULTS.

Industria responsibilities are seldom cleanly demarcated among departments. Indeed, the success of the whole process depends upon the close collaboration among departments and the blurring of lines of responsibility as each department does what is required for success. Research. development and engineering should not be thought of as *belonging* exclusively to departments bearing those titles. If we were to examine the activities of departments which were labeled Research. Development and Engineering, we might find that their activities were distributed more or less as indicated in the following figure.
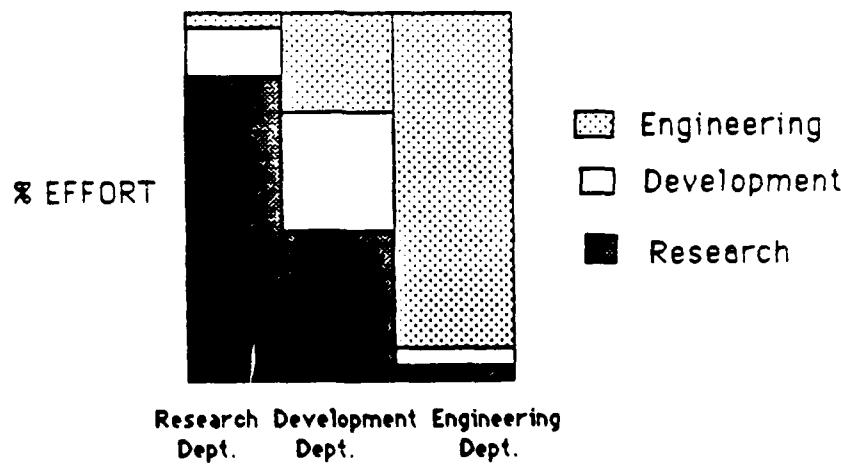

FIGURE 1. How the efforts in research, development and engineering might be distributed among departments bearing those names. The real world is never as tidy as our conceptions of it.

DISTINGUISHING AMONG INVENTION, INNOVATION, QUALITY AND PRODUCTIVITY

The competitiveness of an enterprise in the marketplace depends upon two distinct thrusts:

INVENTION AND INNOVATION: Doing new and better things.

QUALITY AND PRODUCTIVITY: Doing things in new and better ways.

To be *inventive* is to be *creative*. To be *creative* means to be able to generate new alternatives which enhance values. Good inventions have the element of surprise. They are unexpected. They have the character of a *discovery*. Irving Langmuir used to say, "You cannot plan to make a discovery". What you can do is have a *strategy* for increasing the probability of making an invention.

Bill Golomski has differentiated between a plan and a strategy in the following way:

PLAN: When you know what you want to do and you know exactly how to do it, you can make a plan. A plan is characterized by knowing what the <u>next</u> will be. Each step is designed by taking into account the next step.

STRATEGY: When you know what you want to do but you do not know exactly how to do it you require a strategy. A strategy is characterized by not knowing what to do at the next step until you have completed the previous step. Each step of a strategy depends upon what is learned at the previous step.

Plans are for execution; strategies are for learning. Of course nothing in the real world is as neatly packaged as these definition. Nevertheless, it is helpful to keep these distinctions in mind.

Of the four characteristics, invention, innovation, quality and productivity, the last three require the collaboration of many people. Invention, on the other hand, is usually the product of one or at most two or three minds. Management to enhance invention, therefore, is somewhat different than management to enhance innovation, quality and productivity. Invention is not susceptible to scheduling.

Good practices for managing invention and inventors are quite different from good practices for managing innovation, quality and productivity. The latter three depend for their success on the close collaboration of many people. The latter require *management* and *leadership*.

In this presentation I do not intend to say much about the management of inventors. There are two reasons for this lack of emphasis: (1) I believe that American managers know a great deal about the management of invention. When properly funded American industrial laboratories have in the past turned out a veritable cornucopia of inventions. (2) While we have many rules of thumb for managing invention, there does not seem to exist a theory worthy of discussion. I believe that most of the members of the IRI are able to formulate good strategies for encouraging invention.

Instead I intend to focus on the other three: Innovation, quality and productivity, for they require the techniques of quality management. It is important to know how to manage in such a way that the innovation process itself is carried out with quality and productivity. In my opinion, this is the most glaring failure in American management.

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i believe our lack of competitiveness does not come from a failure of our research laboratories. It stems from the fact that American managers do not know how to increase the quality and productivity of the processes they manage; especially the innovation process. At the Federal level this inability to understand our national weakness has lead to a misguided policy of attempting to increase competitiveness by increasing the budget for research. You do not cure constipation by forced feeding.

I realize that this is a harsh judgement. I know it is true when I examine the time and cost it takes for US industry to bring out a new product and sustain it in the market place compared to our most successful competitors, the Japanese. One of my former students is now in charge of the famous "Skunk Works" at Lockheed Aircraft. He speaks proudly of the track record of Kelly Johnson and the fact that new products come from those "Skunk Works" in 1/4 to 1/10 the time it takes to do similar developments elsewhere. If all our development work were managed like the Lockheed Skunk works were managed under Kelly Johnson, there would be no need for this talk.

With respect to manufacturing processes, the data which describe our managerial weaknesses are distressingly impressive. Figure 1 shows data gathered by the Boston Consulting group demonstrating how our disadvantage relative to the Japanese increases as the complexity of the job increases. This graph is clear evidence concerning the importance of management, for it is management which determines how well people are able to cooperate across department lines.

MANUFACTURING COORDINATION

Source: Boston Consulting Group (S Wheelwright)
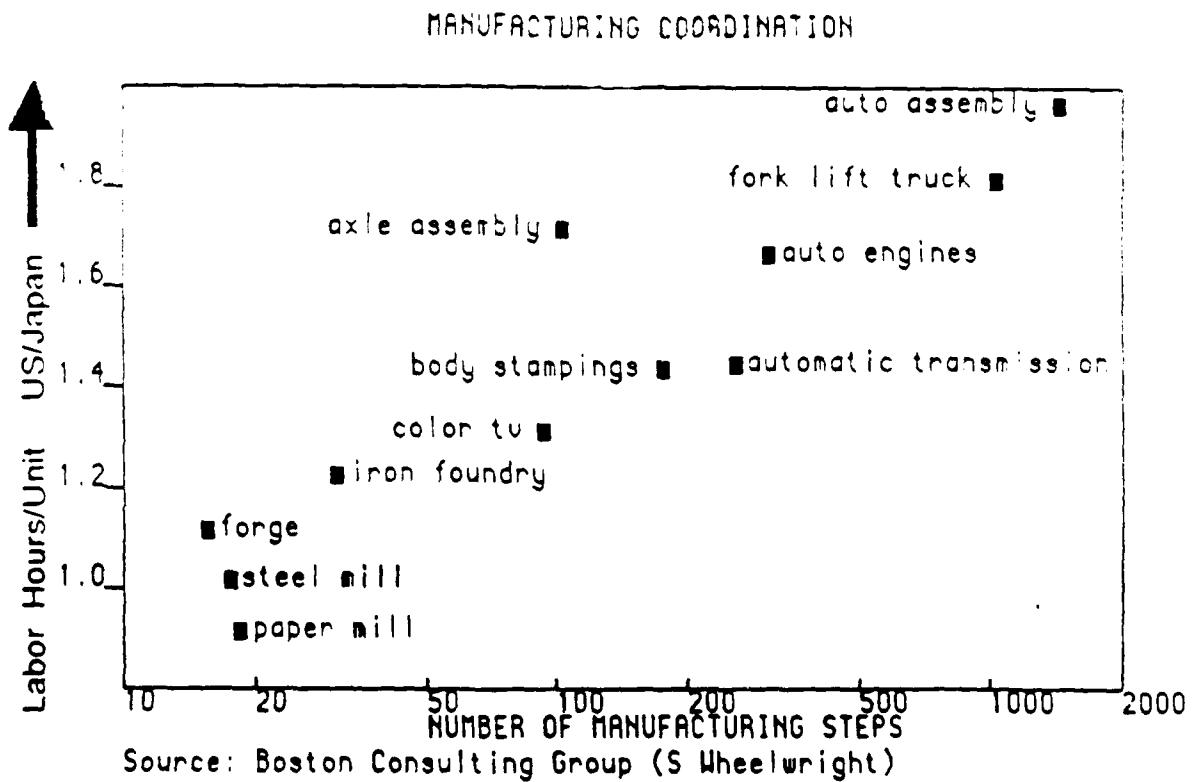
FIGURE 2. The increasing ratio of required labor-hours (US/Japan) as complexity increases is an indicator of relatively poorer managment in the US.

THE PRINCIPLES AND TOOLS OF QUALITY MANAGEMENT

In the following sections I shall be giving illustrations of the application of quality management principles in R&D, concentrating especially upon the innovation process, for it is this process which, in my opinion, needs to be greatly improved if the US is to become more competitive. It is also the process which affects most directly the success of the R&D activities of a company. It is also true that the quality and productivity of all other processes need to be improved, especially manufacturing, sales and service, but these are not the main concerns of this audience, so I shall concentrate on R&D. The literature on quality management in R&D is now quite sparse compared to the literature in the other fields. That is another reason to concentrate on the innovation process.

There are several people who have been especially helpful in my attempts to learn about quality management. In the USA these have been Dr. W. Edwards Deming and Dr. Joseph Juran. In Japan I have benefitted greatly from the writings and teachings of Dr. Kaoru Ishikawa and Professor Yoshikazu Tsuda. In their presentations I find ideas which conflict with current beliefs in this country. I have selected a few as most likely to confront currently held beliefs and notions.

1. THE REDEFINITION OF THE MANAGER'S JOB

THE WORKERS WORK IN A SYSTEM.
THE JOB OF THE MANAGER IS TO WORK ON THE SYSTEM
TO IMPROVE IT
WITH THEIR HELP

The implications which flow from this statement are many.

    a) Managers need to understand how to recognize, define and improve systems. (When I speak of a system I mean the totality of the practices, procedures, protocols and processes whereby the work gets done) Managers need to know how to describe systems so that other people can understand what they are talking about and and can participate in the improvement process. Research managers need to be able to do this for activities for which the products are not physical devices but are intellectual contributions. Too many mangers today concentrate on the product and not the process that produces the product. The flow charts of the chemical engineer or the computer programmer are not sufficient. Organizational charts are even worse, for they obscure the processes by which things get done.

    b) If the workers are to help improve the system, then need to be empowered to do so. This means that managers must not only be willing to share power with their subordinates, they need to help them to use this power through the application of new skills in group problem solving. They need to share information to a greater extent than they now do. Above all, they need to serve as mentors to their subordinates. Mentoring should be an essential part of all managing.

    c) Constant improvement should become a way of life. The old adage, "If it ain't broke, don't fix it" is no longer valid. The good manager deliberately stresses systems which are functioning satisfactorily as a method to find their weakest points so they can be fixed and permit the entire system to function more productively and effectively.

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d) Most managers now need to put much more effort into making sure that every person in the enterprise understands its goals and objectives. This requirement in turn requires the manager to be much less ambiguous about how to tell progress from random motion. The decentralization of authority inherent in the redefinition requires much more policy guidance and much less direct ordering about than under the old ways to manage.

This redefinition of the manager's job recognizes that all workers in all aspects of an enterprise have today become *knowledge workers*. It is especially true in research and development, but it is also becoming a dominant fact in all other activities. The secretary with the advanced wordprocessor and access to every widening data bases is taking on a new role in modern society.

I have spoken loosely about old ideas in management. In my experience, there is no one way to manage which can be called the "American Way". Harvard, Wharton, the Sloan School at MIT all teach many aspects of management. Within these schools one finds a very large range of opinion on management, buttressed by much research and an avalanche of publications. In industry, however, most people seem to learn their approach to management by imitation of what they find about them. Most people, even those who went to management schools, seem to reflect some of the ideas of Frederick Winslow Taylor who is generally considered the father of "scientific management" (a title he firmly rejected at the end of his life, seeing what damage had been wrought in its name). When he was younger he wrote the following lines to describe how he saw the relation between manager and managee:

"Under our system a worker is told just what he is to do and how he is to do it. Any improvement he makes on the orders given him is fatal to his success"

Mr Konosuke Matsushita sees things differently:

"We are going to win and the industrial West is going to lose out; there's not much you can do about it because the reasons for your failure are within yourselves.

YOUR FIRMS ARE BUILT ON THE TAYLOR MODEL

Even worse, so are your heads. With your bosses doing the thinking while the workers wield the screwdrivers, you're convinced deep down that this is the right way to run the business. For you the essence of good management is getting the ideas out of the heads of the bosses and into the hands of labor.

WE ARE BEYOND THE TAYLOR MODEL

Business, we know, is now so complex and difficult, the survival of firms so hazardous. in an environment increaingly unpredictable, competitive and fraught with danger that their continued existence depends on the day-to-day mobilization of every ounce of intelligence."

2. DEFINING THE "INTERNAL CUSTOMER"

**EVERY PERSON SHOULD STRIVE TO SATISFY THE CUSTOMER.
THE CUSTOMER IS THE NEXT PERSON IN LINE IN THE PROCESS.**

Decentralized decision making requires guidance. People need to know what to do when they are able to choose by themselves among alternative ways to do things. This definition of the internal customer provides such guidance. Under the quality management philosophy, the manager inquires of all subordinates to see what they are doing to improve the services they give their customers. In conventional management each person strives to serve his or her immediate superior. The shift in perspective is subtle and important. The emphasis moves from organization to process. Old style management looks something like the following figure.
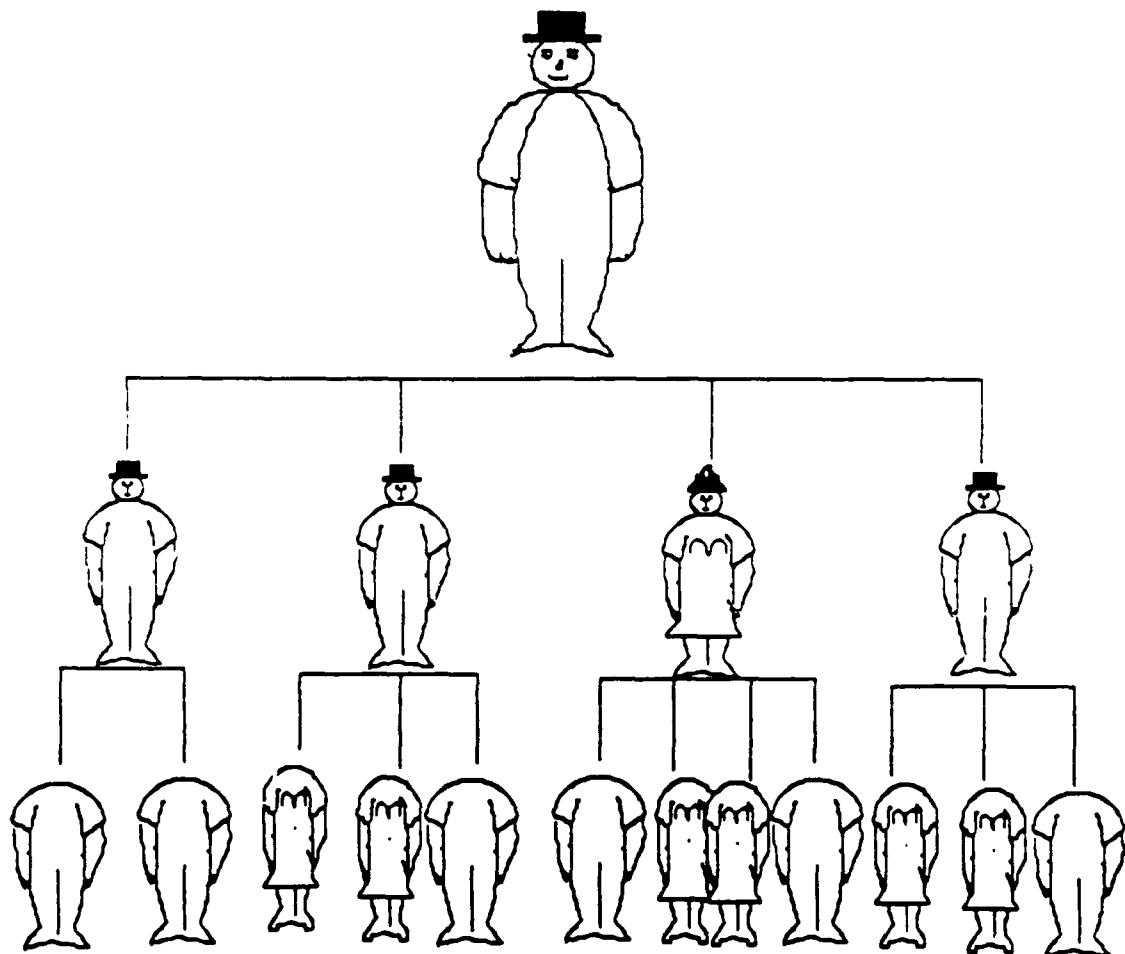

FIGURE 3. The hidden assumption in most organization charts.

Organization charts are not very useful in helping you understand what is going on. When I visited a newspaper I asked the publisher how a paper is put out. He first drew an organization chart, as shown in Figure 4.
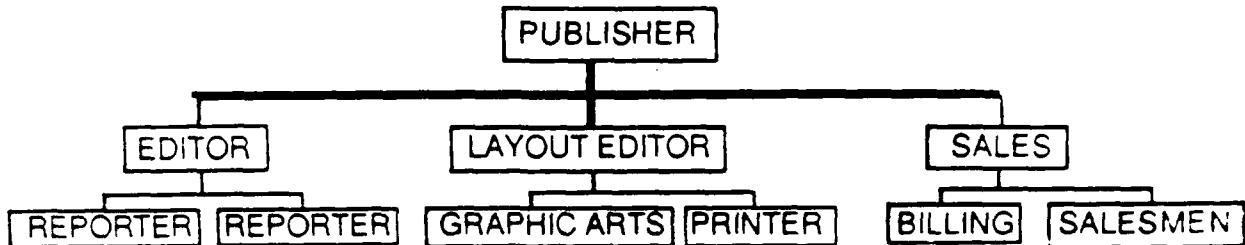
FIGURE 4. Organization chart in a newspaper office.

However, when we developed a flow chart for the process, it became easy to see what happens when a newspaper is "put to bed". The standard symbols for flow charting are shown in figure 5. The flow chart for putting out a paper is shown in figure 6.
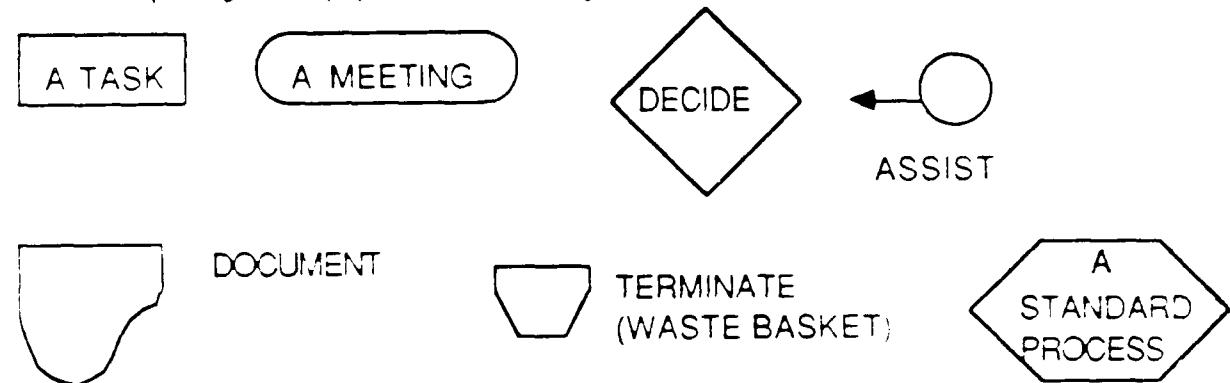
Figure 5. Standard symbols for flow charting.

The important feature of figure 6 is the "people coordinate system" across the top of the diagram. Any activity which lies directly below one of the boxes requires the participation of the person in the box.

A horizontal line defines a "supplier" and a "customer". Each time you see a horizontal line you will recognize that a responsibility has shifted.

The vertical line leading into a symbol indicates who has the responsibility for the activity.

Figure 7 shows the beginnings of a flow chart for the innovation process involving a research laboratory and the top management. This approach is typical of many organizations I visit and I must say it is a good recipe for failure. I have not developed the complete flow chart because the people who make slides complain about how complicated it makes the slide. Some of my clients have developed quite large charts for this process. They are always surprised at what they do. Without flow charting the process you are living the "unexamined life". You cannot improve a process you do not understand. You cannot understand a process involving people, procedures, machines and purposes if you do not flow chart it.

EDITOR	REPORTER	SALES	COPY EDITOR	LAYOUT EDITOR	GRAPHIC ARTS	PRINTER	BILLING	CUST-OMER

GENERATE OR RECEIVE A STORY

OBTAIN AN ADVERT

NEED

INPUT TO THE COMPUTER

MAKE A ROUGH DRAFT

MAKE AN INFORMAL PRODUCT

ACCEPT ?

n

y

EDIT

FORMAL PRODUCT

GENERATE STORY LISTS

IS ADVERT COOP ?

y

n

LIST THE COOP COMPANIES

COMPUTE SHARED COSTS

BILL

LAYOUT PAGES PASTEUP

APPROVE ?

n

y

FLAT CHECKER

PRINT

DISPATCH
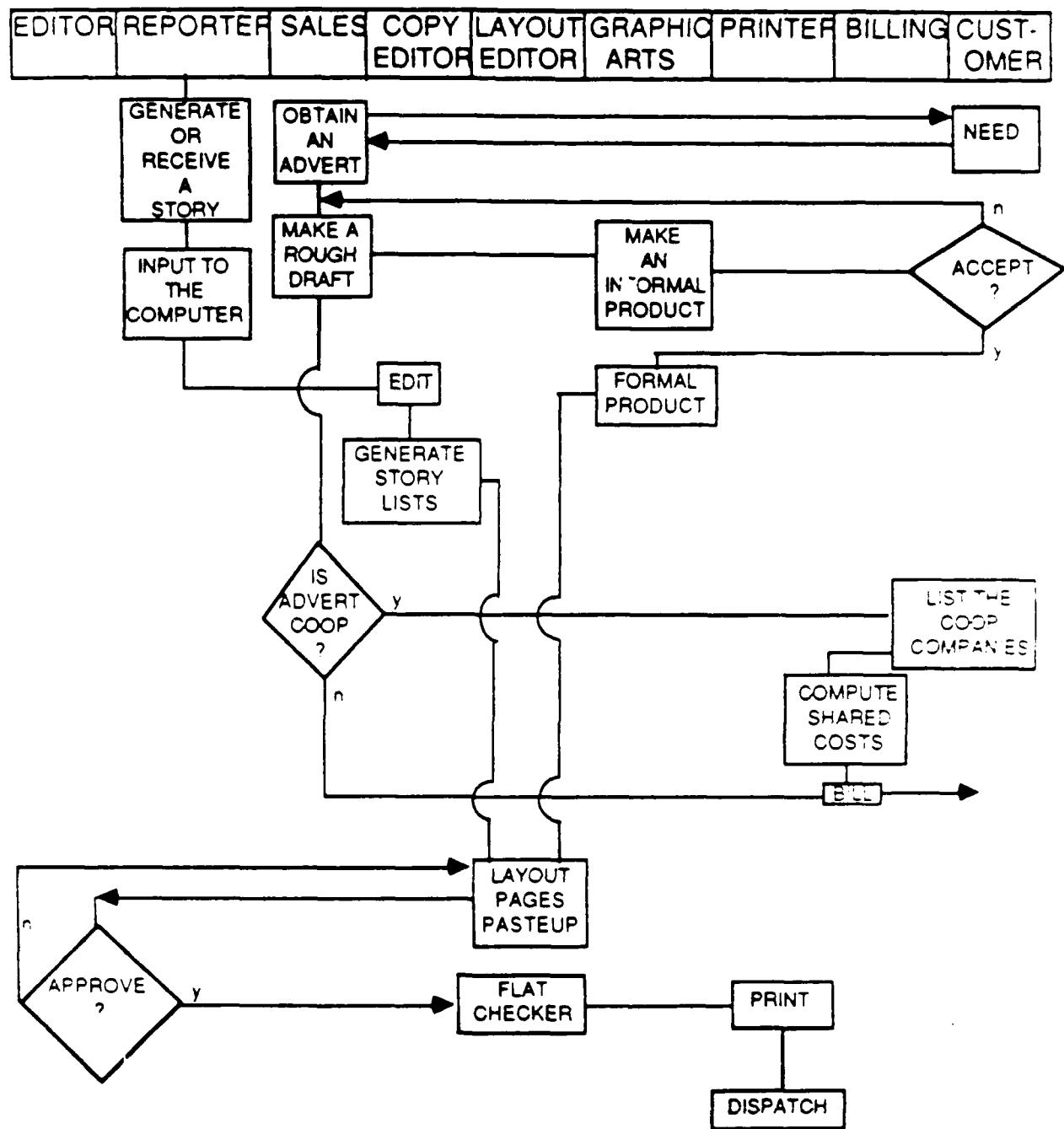
FIGURE 6. Flow chart for putting out a newspaper.

CEO	PRESIDENT	VP FINANCE	VP SALES	VP ENGG	VP MFG	VP RESRCH	RSCH DEPT HD	RSCH SUPRVSR	RSCH WORKER

INVENT

DISCUSS

PRPSL

DISCUSS STRATEGY

BUDGET

DISCUSS JUSTIFICATION FOR PROJECT

SEND FORWARD?

? n EXPLAIN WHY

y

PLAN

$

STUDY

FUND?

?
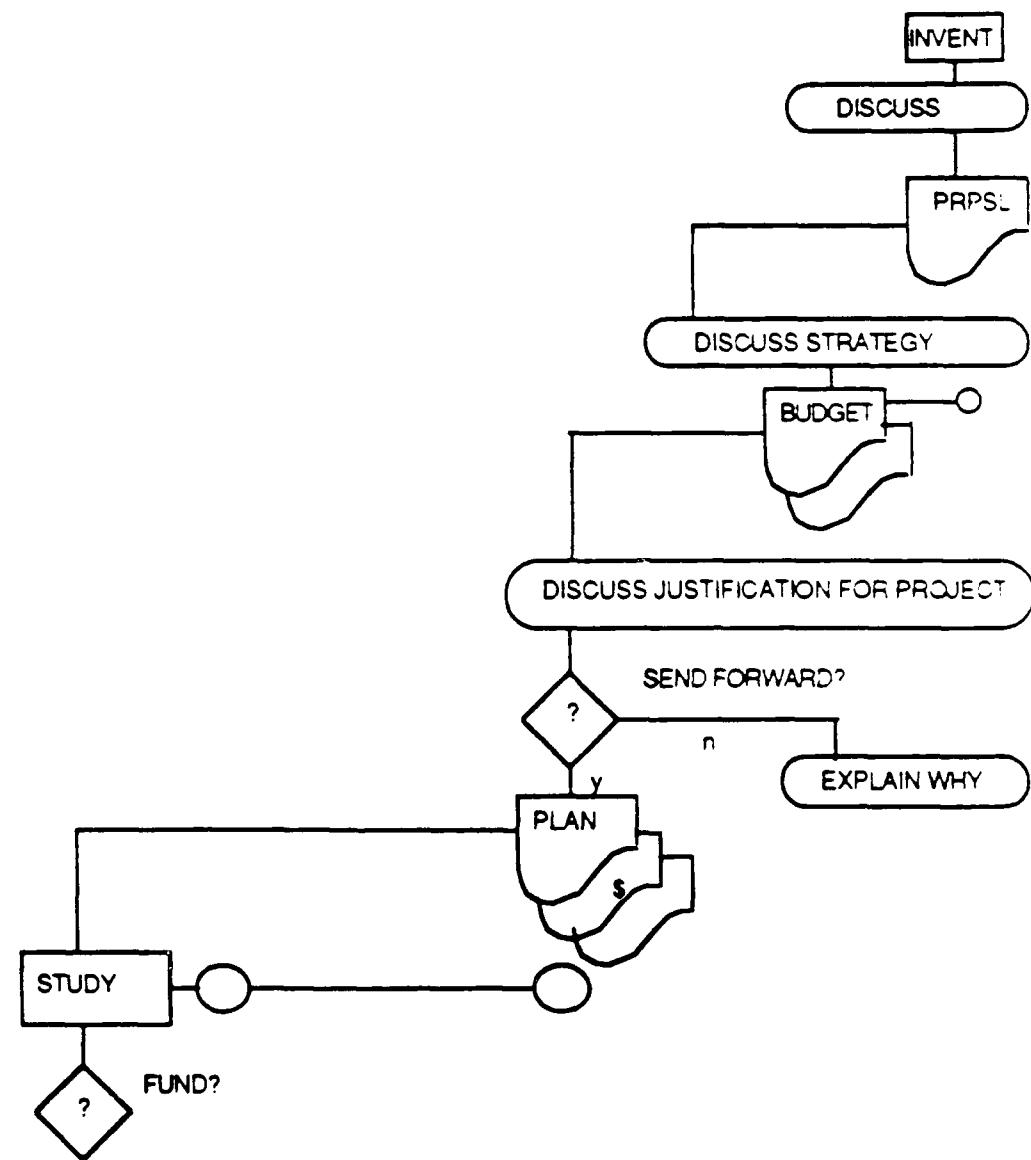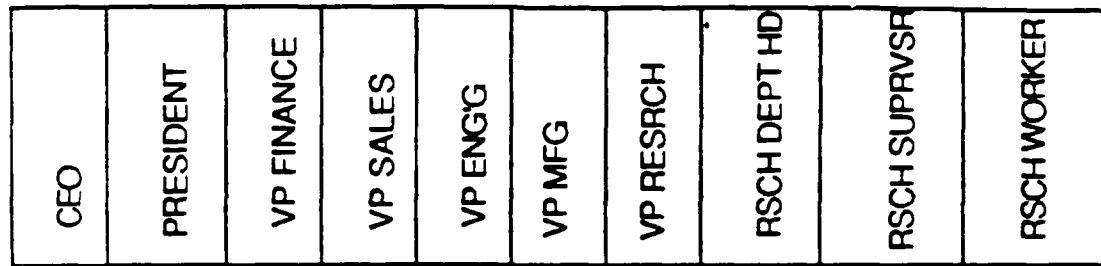
FIGURE 7. A flow chart showing how the people and process come together to begin innovation.

When you see a process diagram, the first question you might ask is, "Who is in charge of this diagram? Why is it drawn the way it is? Is there a better way to do it?" The answer in most cases is, "No one is in charge. That's just the way we do things around here. We have done it this way since the boss was appointed. When we get a new boss we will do it differently".   171

In quality management the rule is: The manager responsible for the final product of the process is responsible to understand how it works and to improve it." Only when the manager accepts responsibility for the system and its improvement can the other questions be answered usefully.

It is unfortunate that in so many people's minds Quality Management has become equated to Statistical Process Control. Too many people think that quality management just consists of applying statistics to production. Statistical methods have an important role to play in quality management, but only in the context of a total systems approach. For example, in a large research laboratory a manager can use a diagram such as Figure 7 to study the fraction of proposals that get turned down at different levels or the amount of time spent on formal proposals that never get to the stage of formal approval and use this information to improve the system through changes in the process, education, the introduction of different procedures and methods of checking.

A competent manager will study Figure 7 and having identified who are customers and who are suppliers at different stages of the work will ask if the suppliers are really trying to please their customers. Or are they just trying to look good in the eyes of their bosses?

A competent manager will ask if the people who supply the information for a decision process understand the criteria that will be used when the decision is made. If you are a decision maker, do you believe that the people who send their proposals to you understand your decision making criteria? If they really do understand it will increase the probablity that you will receive proposals you will be happy to approve. The competent manager takes steps to see that people do understand the criteria. The excellent manager discusses these criteria with subordinates to see if they can be improved upon.

I have given the organizers of this conference the complete paper discussing how these methods apply to the management of a chain of newspapers and I trust they will reproduce it for you. In many ways running a newspaper is much like running a research laboratory. The questions are different, of course, but they both deal with an intellectual output and both are heavily laden with what are called "people problems". That is precisely why this form of diagramming is so important. Many managers are perplexed concerning how to balance what they see as a conflict between their obligations to the work and their obligations to the people. This conflict has been formalized in what has become known as the "Theory X and Theory Y" approach to management. A Theory X manager is supposed to be concerned about the job. A Theory Y manager is supposed to be concerned over the people. A coordinate grid is used to see where a manager fits on the two axes. The "Theory X and Theory Y" way of looking at management tends to treat concern for people and concern for the work as *orthogonal*. That is unfortunate. Experience shows that if the manager improves the system and makes it easier for people to do their jobs, both the work and the morale of the people improve.

On the other hand, the failure to improve systems leads to employee frustration. It deprives people of their right to pride of workmanship. It prevents them from feeling like strong contributors. Too many people have taken the view that work is something people have to do; that it is necessary to work so that when the work is over there will be a chance to live and enjoy life. Their first approach to increasing job satisfaction is to raise salaries. Bribery is not a good policy.

**EVER SINCE THE BUILDING OF THE PYRAMIDS
MANAGEMENT HAS BEEN A PRIVILEGE
LABOR HAS BEEN A COMMODITY**

**THIS PHILOSOPHY WILL NOT WORK ANY MORE
WE ARE IN THE ERA OF THE "KNOWLDEGE WORKER"**

When the organization is managed with a view towards helping each person to do the work more efficiently and without frustration, to serve a customer efficiently, and when each manager understands management as being responsible for constant improvement, managers will be regarded by the workers as a useful source of help, not as a curse. Old style management has attempted to solve problems all at once from a central point. We now understand this is just not possible. The effective organization is solving problems at all points in the system; everyone's mind is engaged in improvement.

3. MAKING IMPROVEMENT A WAY OF LIFE

Managing for constant improvement should not be restricted to a few departments. It must become pervasive if it is to be successful. This means that everyone has a role in the improvement process, everyone from the very top of the organization to the lowest echelons. Figure 6 suggests how people at different levels should distribute their time.

Bd. of Directors

C. E. O.

Executives

Managers

Supervisors

Workers

FUTURE

IMPROVEMENT

OPERATIONS
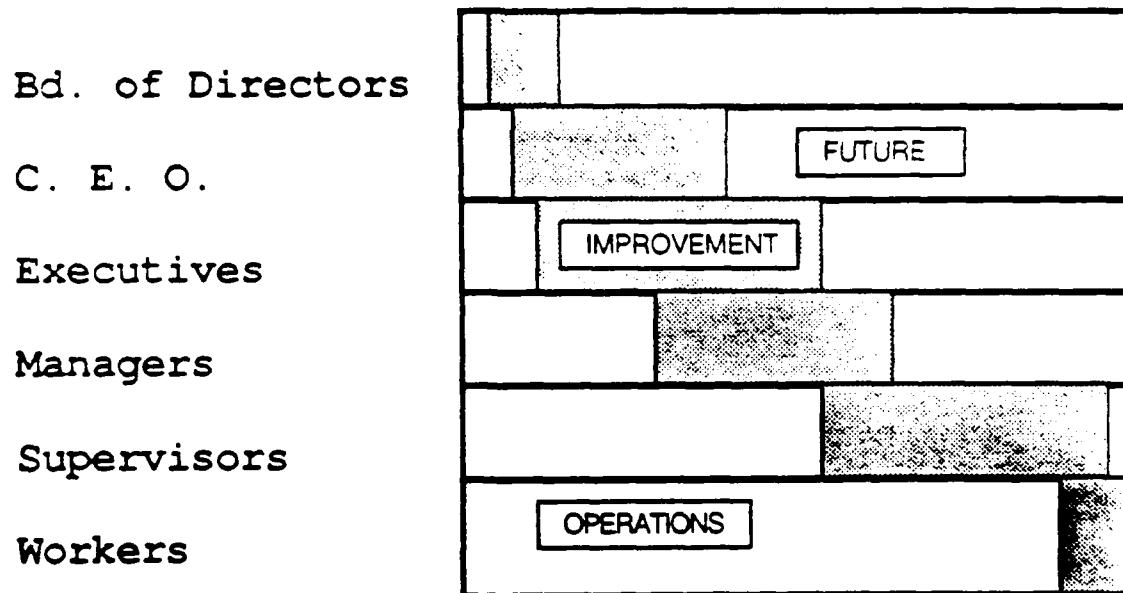
Percentage of time Spent

FIGURE 6. The distribution of effort at different levels in a quality enterprise.

If everyone in every part of the organization is engaged in improvement it makes the entire organization more receptive to the changes which flow from research. If each worker is trying to please the boss by getting the work out according to schedule and is told "keep your mouth closed and look busy", the workers will not welcome any change in the work environment. Once they have figured out how to foil the bosses, they want things to stay as they are. If the upper levels of management think they are supposed to make things better, workers will welcome new ideas. 173

When we say we intend to "improve" things most people think that everyone in the organization understand how to tell "best" from "merely good". My experience suggests this is not true. Most people have much too narrow a perspective on what constitutes an improvement. For example, they cannot answer questions such as "Better for whom?" "Better by what measure?" "Better by a single measure or a composite one? If so, how are the measures combined?" "Better within what constraints?" The commitment to constant improvement requires that the management itself be much clearer on how to distinguish improvement from mere change.

Although the objective of everyone may well be to increase the competitive position, and therefore the profitability of a company, it is very difficult for most people to see how to trace their own contributions to the "bottom line". Although the bottom line is useful to measure the past performance of a company; it is a very poor indicator for what is happening at the moment. The economic performance of an enterprise is a *lagging indicator.* It is not a good *leading indicator.* General Motors, for example, showed very good economic performance almost right up to the time they faced the most important crisis in their history. Never discount the power of creative accounting. We all know that the good performance of a company today is due to decisions made within the company five or even ten years ago. Trying to make decisions based on monthly financial data makes as much sense as driving your car down the highway guiding it by the white line in the rear view mirror. In the quality company managers know how to judge improvement by *leading indicators.* These indicators are called the *quality indices of a company.* Every manager should learn how to identify quality indices and manage by them.

In a research department these indicators should be developed by the people themselves. Everyone should be asked to answer the question: "If someone else had your job, what would you tell me to watch to see if they are doing an outstanding job?" If you ask this question of most people you will find they cannot answer. Most people have been content to get the work from the "in" basket to the "out" basket. Being excellent has not crossed their minds.

As I consult with various clients I am impressed by the fact that most people do not know where to start if you ask them to propose improvements in what they do. At the upper levels of the company the managements have not been trained to do this. They do not look upon their employees as problem solvers. At the lower levels the people are simply unaccustomed to this kind of activity. People who think of themselves as low on the organizational totem pole are often very uncomfortable if asked to propose improvements.

While people have not been trained to improve things, they seem to know how to gripe without any particular training. This capability may be used constructively through the construction of what should be called a "negative Ishikawa diagram". I first used it in an unexpected circumstance. One of my clients one day thrust me into a room full of secretaries with the announcement, "Dr. Tribus is here to help you improve things" after which he withdrew and left me to face about 15 women, none of whom had been told anything except that I was some kind of efficiency expert. To them the words "improve things" were code words for "Let's get those papers filed faster, make fewer typing errors and get the work out in greater quantity". Their tension and apprehension matched my own. My attempts to achieve rapport were not successful. No one had prepared them (or me) for what we were to do.

In desperation I hit upon the following approach. I asked them to help me with a project. "I am considering the preparation of a new movie which will be a follow up to the movie 'Nine to Five' in which a group of secretaries took over the running of an office. In my version of the movie there is a secretary who is absolutely fed up with her job. The boss is not very nice and the rest of the people are worse. She has decided to quit and when we see her in this scene she has just finished

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typing up her letter of resignation. As she is pulling it from the typewriter, the boss comes in and in his usual manner ignores her attempts to speak and says: 'Millie, I want a meeting with Ed, Tom, Bill and the other department heads. I want to meet them on the 15th to discuss the sorry economic projections they are making'. With that he leaves the room and it dawns on Millie that the meeting will occur after she has left the company. She decides to arrange the worst possible disaster of a meeting that she can. Will you help me plan it?"

I used Nominal Group Technique (NGT) to obtain their proposals for a disastrous meeting. NGT is a method to obtain the ideas from a group of people in such a way that no one is forced to speak out and yet everyone has an equal time to speak. The Ishikawa diagram is a convenient way to organize ideas and see how they contribute to a central theme. Figure 6 shows the kind of diagram they generated.
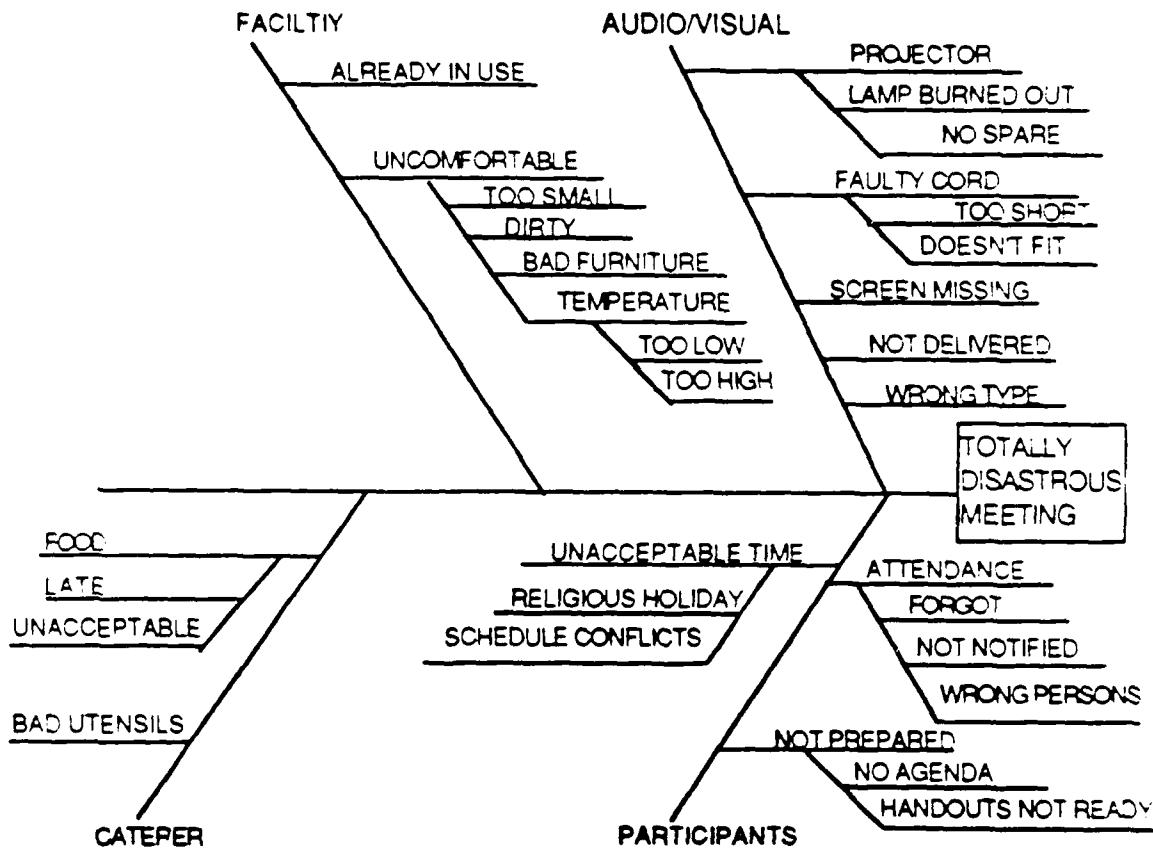
FIGURE 8. A "negative" Ishikawa diagram showing some of the things it takes to produce a disastrous meeting.

Figure 8 is far from complete. I brought the diagram home to my office and showed it to the staff. We put it on the blackboard and from time to time different people added ideas. Finally my secretary undertook to design a process flow diagram which would be the opposite of figure 8. Her objective was to design a process which would head off each of these unpleasant effects. Her diagram is shown in figure 9.

As the diagram in figure 9 shows, there are two parts to the chart. The process is shown in the center of the diagram, indicating how the people and the work interact. To the right there is a column in which the various things which affect quality are described. The Ishikawa diagram (also

Quality Management in R&D
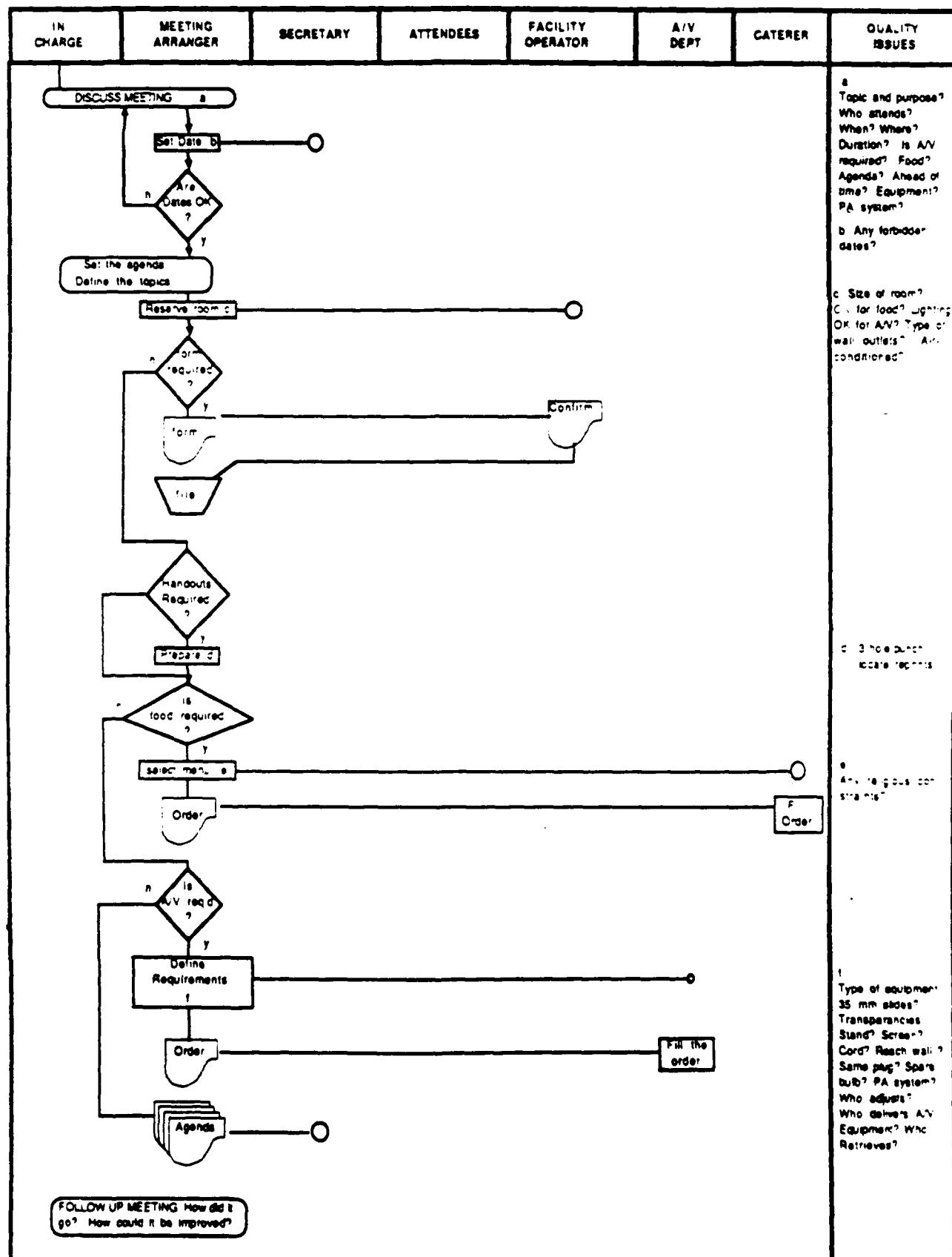
FIGURE 9   Flow chart for organizing a meeting

called a "cause and effect diagram") serves to guide the construction of the process. Anything important to the quality which cannot be included as part of the process is called out in the column to the right of figure 9.

It is important that the person who is supposed to follow the process be the author of it. If a manager were to prepare this diagram and then hand it to someone with orders to follow it, they usually won't do it. The difficulty, you see, is that most people are flawed in the same way as you and I!! We do not like to be "programmed" by someone else. We want to do things our way. We also want to do a good job. That is why it is important that procedures be designed by the people who are expected to follow them and not someone else.

The development of useful flow charts is straightforward. There are four relatively easy steps to take.

> 1. Develop an Ishikawa or "fishbone" diagram showing the elements it takes to make the activity successful. It sometimes helps to make a "negative Ishikawa diagram" since it is often easier to think of how to make things go wrong than to remember what it takes to make them go right.

> 2. Develop a flow chart which will take into account the as many of the desireable characteristics as you can *procedurally*.

> 3 Take into account the matters which cannot be handled procedurally by listing them in a column on the right side of the diagram.

> 4. Do all of these things in close collaboration with the people who have to do the work. If at all possible have them do steps 1,2 and 3. Sometimes you have to make the first diagram, just to give people an idea of how you want things to be done, but afterwards you should turn the task of developing the flow chart over to the people who are going to do the work.

Be sure to end your diagram with a step that calls for a periodic review of their experience with the procedure so as to make constant improvement an automatic part of the process.

4. QUALITY FUNCTION DEPLOYMENT

A new tool in quality management, called "Quality Function Deployment", is now being introduced into the USA. I prefer to refer to the "Quality Characteristics Evolution Diagram" and the "Quality Management Matrix", for the tool consists of two related parts. The first part, illustrated in figure 10, shows part of a Quality Characteristics Evolution Diagram. In this diagram the primary interests of the customers of the laboratory are shown at the extreme left. These are stated first in broad categorical terms. Then each category is considered in more detail. It is customary to use at least three levels of discourse, sometimes four are used. The most important feature of the diagram is that it is always (or should always be) couched in terms of the customer's vocabulary and interests. Figure 10 treats the engineering department as the primary customer.

Figure 10 is incomplete in that it does not deal with all customer interests. For example a research laboratory should be a "window on the world of science". It should provide early warning on important technical developments which affect the future of the company.

Research laboratories are also expected to provide consultation on new problems which arise in connection with products already in use. Research laboratories often furnish personnel for

Quality Management in R&D

emergencies which arise from law suits, warranty problems, patent infringements, etc. Each of these activities should be described in three levels, each level going into finer detail but always expressed in terms of the value judgments of the customers.
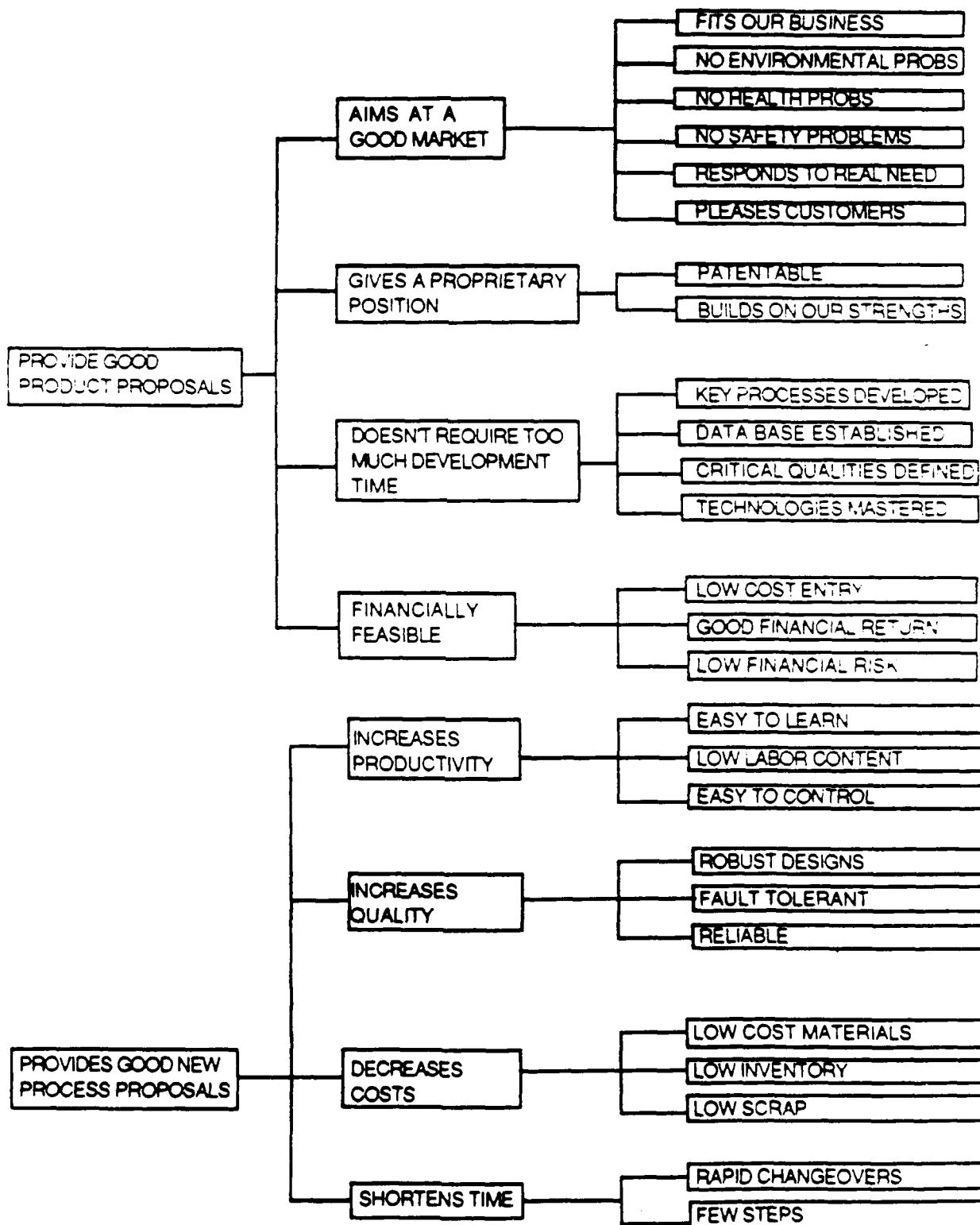
FIGURE 10. Quality Characteristics Evolution Diagram for Research Laboratory (incomplete).

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	JOINT QUARTERLY REPORT WITH MARKETING	QUARTERLY RL REVIEW OF EPA REGULATIONS	RL QUARTERLY REVIEW OF OSHA REGULATIONS	RL QUARTERLY REVIEW OF NEW PATENTS	RL STANDARD PROCESS RELEASE PROCEDURE	PROJECT REVIEW JOINT WITH ENGINEERING	JOINT RL/FINANCE PROJECT REVIEW
FITS OUR BUSINESS	©						
NO ENVIRONMENTAL PROBLEMS		©					-
NO HEALTH PROBLEMS			©				
NO SAFETY PROBLEMS			©				
RESPONDS TO REAL NEED	©						
PLEASES CUSTOMERS	©						
PATENTABLE				©		-	
BUILDS ON OUR STRENGTHS							
KEY PROCESSES DEVELOPED					©	©	
DATA BASE ESTABLISHED					©	©	
CRITICAL QUALITIES DEFINED					©	©	
TECHNOLOGIES MASTERED					©	©	
LOW COST ENTRY						o	©
GOOD FINANCIAL RETURN	o						©
LOW FINANCIAL RISK	o						©
EASY TO LEARN						o	
LOW LABOR CONTENT						o	
EASY TO CONTROL					o	o	
ROBUST DESIGNS						o	
FAULT TOLERANT						o	
RELIABLE						o	
LOW COST MATERIALS						o	
LOW INVENTORY						o	
LOW SCRAP							
RAPID CHANGEOVERS							
FEW STEPS					o	o	

© = covers completely   o = bears upon

FIGURE 11. The Quality Management Matrix (incomplete)

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The extreme right hand column of the quality characteristics evolution diagram provides a useful check list against which to examine how the laboratory is managed. This column identifies the rows in what is called a "Quality Management Matrix" The columns of the matrix itself describe the activities carried out in the research department. At the intersections the symbol © is used if the topic is well covered, o if it is partially covered and the entry is blank if the activity does not cover the topic at all.

A quick study of figure 11 reveals a number of deficiencies. For example, the concern to produce small amounts of scrap should be dealt with by a suitable joint review with manufacturing. Indeed. manufacturing is conspicuous by its absence.

The manager should study the two diagrams to see if important things have been omitted. The quality evolution diagram should be discussed with all the research laboratory customers. Each row of the diagram should be examined to see that the topic is satisfactorily covered. Each column should be examined to see if by a change in procedures, more topics may be covered.

The manager should list at the top of the matrix ALL the activities of the Research Laboratory which are the subjects of review. If a column shows up without application it is a signal to examine if the activity is necessary.

CONCLUSION

This paper contains only a brief review of some of the tools available to improve the quality of the operations of a research laboratory. It has exposed only the tip of the iceberg.

The tools of quality management apply quite well to research and development. All that is required is for managers to believe that this topic is important enough for them to make *the commitment to learn*. In my experience the lack of *a commitment to learn* on the part of managements has been the energy barrier to the transformation process.

The condition of American management has been described by Don Alstadt. CEO of the Lord Corporation in these words: "Overmanaged and underled". Increasing the quality of the performance of a research laboratory begins with an increase in the quality of the performance of its managers. It starts with you.

3-6

Quality Planning for Service Industries

Raghu N. Kacker

Quality Planning for Service Industries

High-quality
services can
be achieved.

by Raghu N. Kacker

SERVICE-PRODUCING IN-dustries must plan for quality to ensure that high-quality services are produced efficiently. Because some work processes in service-producing industries are similar to those in goods-producing industries, the basic approaches to achieve high quality and productivity are similar. There are some aspects of the service process, however, that differ and need to be addressed separately.

Relevant theories and practices

The theories and principles advocated by such quality leaders as W. Edwards Deming, Joseph M. Juran, and others are relevant not only in the manufacturing setting, but also in the service sector. Deming emphasizes that productivity increases with improvement of quality.[1] Indeed, both high quality and high productivity result when the work processes are designed and operated optimally. The focus of improvement, therefore, must be on the design of the process and the way it is operated.

Juran's quality trilogy lists three basic methods to improve the design and operation of work processes:[2] quality planning, quality control, and quality improvement. Quality planning is preparing a process to meet quality goals under operating conditions. Quality control is meeting quality goals during operations so that all operations are in accordance with the quality plan. Quality improvement is achieving unprecedented, superior levels of performance in the operations. The components of the quality trilogy are analogous to the three components of total quality control defined by Armand V. Feigenbaum:[3] quality development, quality maintenance, and quality improvement.

> ### Steps to Achieving Quality in a Service Industry
>
> 1. Produce services that satisfy customer needs and expectations
>   - Identify the customers' needs and expectations
>   - Translate the customers' needs and expectations into required characteristics of the service
>   - Establish the target value and intermediate goals for each characteristic
> 2. Produce the required services efficiently
>   - Plan to obtain the desired output the first time
>   - Minimize process complexities
>   - Minimize chronic problems
>   - Make the process immune to inadvertent human errors
> 3. Plan for quality control and quality improvement under operating conditions
>   - Make the actual process highly visible
>   - Implement quality control methods
>   - Implement quality improvement methods
> 4. Pay special attention to the features unique to the service industries
>   - Auxiliary and unobligatory services
>   - Waiting time and action to provide the service
>   - Multiple choices to customers

Quality control is often a prerequisite for quality improvement, but the only thing quality control itself does is maintain prevailing quality standards. Thus the primary methods for attaining unprecedented, superior levels of quality are quality planning and quality improvement.

The degree to which a company can implement the quality trilogy and succeed in attaining quality are limited by the managerial environment (the prevailing management philosophies, policies, and procedures). The managerial environment determines the company's culture and work ethics. Feigenbaum[3], Deming[4], Kaoru Ishikawa[5], Juran[6], and Thomas J. Peters and Robert H. Waterman[7] have provided great insights into the characteristics of managerial environment that are necessary to sustain quality efforts.

Application to service processes

The main goals of service quality planning are to produce services that satisfy customer needs

and expectations, to produce the required services efficiently, and to plan for quality control and quality improvement under operating conditions. Most of the concepts and methodologies discussed here apply to both new and existing processes.

1. Produce services that satisfy customer needs and expectations. The first step in quality planning is defining the services that satisfy customer needs and expectations. Clear definition of the required services is accomplished by identifying customer needs and expectations, translating the needs and expectations into required characteristics of the service, and establishing the target value and intermediate goals for each quality characteristic.

To identify the customers' needs and expectations, it is necessary to communicate with the customers. A list of the attributes of service required by the customers and their perceived importance of these attributes should be compiled. Remember that customers' views change with time, depending on their knowledge, experience, available alternatives, prevailing economic conditions, etc.

Most service processes involve a greater interaction with the end customer than manufacturing processes, often making it easier to identify customer needs and expectations. Sometimes primary customers are invited to voice their views at the planning stage. When the customer population is very large, market research surveys are used.

There are many obstacles in determining needs and expectations. For example, customers usually express their needs and expectations in their own language, which may be different from the technical language of the service suppliers. Even when customers use the language of suppliers, the implied meaning may be different. The suppliers should make concerted efforts to understand the customers' viewpoint.

Once the customers' needs and expectations have been identified, they must be translated into required characteristics of the service. In manufacturing situations, product quality deployment is used to translate the list of the attributes desired by the customer into a list of product characteristics in technical language.[8] A similar approach, service quality deployment, can be used in service industries.

After the service characteristics are identified, the target value and intermediate goals for each characteristic must be established. The target value, which is the ideal state of a characteristic, must be known to ensure continuous quality improvement. The intermediate goals are the standards to be met within a given period of time under operating conditions. For a critical characteristic, there are no intermediate goals, just the target value. For example, financial institutions cannot afford to make any errors in the customers' account balances: the only goal is no accounting errors of any kind.

People who are responsible for meeting the goals should participate in establishing them. This will make it easier to attain the goals under operating conditions. The goals should not optimize one characteristic at the expense of another. The goals of different characteristics must be balanced, and this balance must agree with the customers' priorities. Process capability should be continuously improved, and as it improves, the goals should advance toward the target value.

2. Produce the required services efficiently. After the required services have been defined, the next step is to develop a process that can produce them efficiently. The efficiency and effectiveness of work processes can be improved by obtaining the desired output the first time through, minimizing process com-

plexities and chronic problems, and making the process immune to inadvertent human errors.

A process that fails to produce the desired output the first time through is necessarily ineffective and inefficient. The output must be inspected and reworked, causing lower productivity. Further, the quality of the output that has been reworked is often questionable.

According to Deming and Juran, most of the quality and productivity problems can be traced to the system. The object of quality planning is to design the system so that the desired results are obtained the first time through. The obstacles to effective quality planning include time constraints, lack of resources, lack of training in technical aids for quality planning, and lack of relevant experience. Trying to improve inefficient processes under operating conditions only postpones the problems—it does not solve them. The result is a great loss of time and money.

Process complexities, as defined by F. Timothy Fuller, are the extra process steps that are required to deal with errors external to the process or internal errors in the process.[9] Tremendous gains in productivity can be achieved by reducing errors and eliminating complexities. The root cause of process complexity is management's response to errors. Managers are usually short on time and resources. Thus some take the easy way out: they deal with the symptoms of errors rather than cure the causes of errors. For example, when some managers notice errors, they install extra inspection and correction steps. This approach may be necessary as a temporary measure. Too often, however, the extra inspection and correction steps become a permanent fixture. People forget the reasons why these extra steps were put in place. The distinction between the real work that adds complexity and the extra step (complexity) that adds cost disappears. People start accepting complexity as a necessary and unavoidable aspect of doing business. Fuller estimates that complexity accounts for about 65% of the total work done in many large U.S. corporations.

Existing processes can be improved by identifying complexity by work sampling and flow charting,[9] identifying the errors that are responsible for the extra steps, reducing errors, and eliminating the extra steps. Fuller notes that the more complexity in a process, the more quickly and easily significant improvements can be made.

Many work processes repeat chronic errors because they are modified versions of previous processes that had problems. Even newly created, one-of-a-kind processes are built on relevant experiences with similar processes. Chronic errors are pervasive and often believed to be unavoidable because most organizations have diffused responsibilities for their diagnosis and remedy. Most process planners have no incentive to take the time to diagnose and remedy chronic errors; usually they are rewarded for developing new processes in a timely fashion. No one takes notice of chronic errors. Process planners should assume the responsibility of minimizing chronic errors. This requires time, resources, and a structured approach to diagnosing and correcting problems, such as Juran's breakthrough sequence.

One special class of errors that can be minimized by proper planning is inadvertent human errors. Such errors exhibit a random pattern: nobody can predict what the error will be, when it will be made, and who will make it. The main cause of inadvertent errors is the human inability to concentrate continuously for a long period of time. External distractions can also induce such errors. Inadvertent errors are prevalent in routine and boring operations such as assembly, checking, and inspection. There are two countermeasures against them: make the work process immune to errors, and build in mechanisms to detect and correct errors that do occur as soon as they occur.

Making the process immune to errors means designing the process so that tasks cannot be performed unless the person doing it devotes complete attention to it and to nothing else. This requires great insight into the actual work processes. One way of gaining this insight is to seek suggestions from the people who do the work.

The second countermeasure is to build in mechanisms to detect and correct errors promptly. For example, many utility companies use a computerized system to verify all invoices they mail out to prevent the mailing of incorrect invoices to their customers. The computer rejects invoices that are out of a predictable range. The rejected invoices are then rechecked.

3. *Plan for quality control and quality improvement under operating conditions.* A process that is not effectively controlled and improved under operating conditions tends to get worse. Often, not all difficulties in the operating environment can be foreseen at the planning stage. Therefore, it is necessary to plan for control and improvement under operating conditions. I _t service processes are frequently not planned from the viewpoint of subsequent control and improvement. An essential step in quality planning for service processes is to make these processes more amenable to quality control and improvement by making the actual process highly visible, and by implementing quality control and quality improvement methods.

A process that is not highly visible hides quality problems. When the actual process is highly visible, it is easy to trace the origins of poor quality. The traceability to the causes of problems is crucial for control and improvement. Further, the remedies for many quality problems become obvious when the actual

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An essential step in quality planning for service processes is to make these processes more amenable to quality control and improvement by making the actual process highly visible, and by implementing quality control and quality improvement methods.

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process is understood. A clear understanding of the actual process is essential for control and improvement.

The first step in understanding a process is to define it. A large percentage of service processes are not well defined because service-producing personnel are unaccustomed to viewing their work activities as distinct but interrelated process steps. A clear process definition has three components:[10]
- A description of the overall process
- A description of the subprocesses and requirements at the interfaces
- A clear ownership of the subprocesses and combinations of interlinked subprocesses.

A written document should describe the whole process. This document is crucial when the process consists of multiple work activities and involves several people. The process description should identify all subprocesses and explain their functions and relationships. This document must not be too cumbersome or

hard to understand. A useful technical aid for describing a process is a flow chart.

When the process involves multiple work activities, it should be partitioned into subprocesses, each having clear boundaries and interfaces, and performing well-defined work activities. Since many quality problems result from lack of proper communication at the interfaces of subprocesses, the input and the output requirements at each interface should be clearly defined.

A diffused ownership of work activities leads to lack of responsibility and control. Each subprocess should have an owner. A clear description of the subprocesses and interfaces makes it easier to establish ownership. In addition, somebody must be responsible for ensuring that the subprocesses are properly integrated.

Frequently, a process is well planned and defined on paper, but the actual process is very different from the documented process. A large difference indicates that either the documented process is unrealistic or that people are not following it. An investigation of the differences between the actual process and the document process should reveal the root causes of quality problems.

To maintain acceptable quality standards during operations, abnormal deviations must be identified and corrected. This control process consists of comparing the actual performance with the standard, and taking corrective actions to reduce abnormal deviations. To implement a control process, one must: establish process checking points; establish a means of measurement and a standard for comparison for each characteristic; and set up methods to determine both the causes of abnormal deviations and the proper corrective actions.

Process checking points are the locations for collecting data to evaluate process conformance to standards. These data are the basis of quality control. The data may signal the need for corrective actions. Since the proper corrective actions are based on the knowledge of the true causes of abnormal deviations, process checking data should be collected and expressed in a form that makes it easy to trace the true cause of abnormal deviations.

The natural locations for process checking are the boundaries and the interfaces of subprocesses. At these locations one can determine the extent to which the input and the output requirements are being met. Also, process checking at interfaces discovers abnormal deviations from the standard before they are carried over to the later steps.

Effective quality control is a prerequisite for quality improvement. Therefore the quality planning activities necessary for quality control are also necessary for quality improvement. There are additional managerial activities that can aid a quality improvement program.

A quality improvement council of upper managers can be organized to initiate and steer quality improvement projects throughout the company. In the absence of such leadership, some lower-level managers can impede quality improvement activities. Further, most remedies for long-standing quality problems are management controllable. Upper managers can ensure that the remedies are implemented.

Most improvements happen project by project. The council can help in identifying the projects, setting priorities on the projects, and providing the resources (people trained in quality improvement methods, time, and money) for project-by-project improvements throughout the company.

For each quality improvement project, an interdepartmental project team can be organized. This team is responsible for bringing the project to a successful conclusion. In most cases, the path to success consists of two journeys: a diagnostic journey and a remedial journey.[11]

Quality Planning for Service Industries cont.

The diagnostic journey begins with the precise definition of the problem needing improvement and ends with the diagnosis of the root causes of the problem. The remedial journey starts with the search for the remedies and it ends with the implementation of the remedies to attain superior quality levels under operating conditions. The partitioning of quality improvement activities into the diagnostic and remedial journeys emphasizes that it is usually impossible to find the remedies until the root causes are diagnosed first.

The project team should include people from all concerned departments because most chronic quality problems and their remedies are interdepartmental. People from different departments bring in different ways of looking at the same problem, and diverse views make it easier to diagnose the problem. Also, when all concerned people are involved in the projects from the beginning, it is easier to develop a consensus and implement the remedies. An interdepartmental team will ensure that the remedies improve quality from the company-wide perspective rather than narrow departmental views. Project teams are usually dissolved after project completion.

Special aspects of service processes

Although the basic approaches to attain quality are common to service-producing and goods-producing industries, some aspects of service require added emphasis.[12] Service industries, for example, must pay attention to: auxiliary and unobligatory services, waiting time and action to provide the service; and multiple choices to customers.

Auxiliary and unobligatory services are extra services that are provided in connection with a primary service or a product. Auxiliary services are expected by the customer; failure to provide them results in customer dissatisfaction. Unobligatory services may be expected by the customer, depending on the prevailing convention, when they are provided, the customer is pleased. Juran refers to auxiliary and unobligatory services as services for customer well-being.[12] Auxiliary and unobligatory services include

- no breaks in service. Often service industries are obliged to make provisions for maintaining continuity of service despite failures. For example, transport companies provide alternate means of transportation in case of breakdowns.
- safety. The safety of the people and their property is a vital aspect of service. For example, airlines are responsible for the safety of all passengers and their belongings.
- information to reduce the customer's anxiety and inconvenience. For example, when a telephone company cannot provide a telephone connection to a customer in time, the customer must receive early warning on changes in schedule; this information must be continuously updated.
- clearly explained instructions. For example, the printed instructions that come with products must be easy to understand. Unclear instructions can harm or at best annoy the customer.
- extra services at no extra cost. For example, some automobile service stations clean the windshield and check the status of oil, tires, and batteries when customers get fuel.
- services to make the customers feel important. Since the customers pay for the services they order, most customers expect attention, consideration, courtesy, and respect from the service provider.

Most manufactured products are produced in the factory and then delivered to the customers. The production and the delivery processes are distinct and sequential processes, so the delivery schedule is usually treated separately from product quality. Services, on the other hand, are often produced after they are

ordered. The waiting time to access the service and the action time to receive the service are usually regarded as integral aspects of the quality of service.

When someone visits a dentist, for example, the waiting time includes the access time to get an appointment and the waiting time in the dentist's office. The action time is the time the dentist takes to provide satisfactory dental services. From the customer's viewpoint, the waiting time and the action time are important aspects of the quality of the dental service. Service industries have to identify the relevant components of service time from the customer's viewpoint and set goals for these components. The processes of providing the service should then be planned to attain these goals.

The customers of service industries have a wide range of needs, expectations, and preferences. In addition, these customers have wide differences in their abilities and willingness to pay for the desired services. Many service industries, therefore, provide multiple choices to reach a large number of customers. For example, insurance companies provide complex combinations of coverages to suit the client's willingness to take different kinds of risks. Similarly, most telephone companies provide two-party lines, economy, and regular connections to residential customers.

High standards of quality and productivity in service industries are achievable if quality is planned for. The approaches described here provide a framework from which a company can build an effective quality process. The framework includes approaches that are common to goods-producing industries and those that are unique to the service industries.

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SECTION 4:

CASE STUDIES: SPECIFIC APPLICATIONS OF TQM

4-1   Hunter, W., O'Neil, J., & Wallen, C. (June 1986). *Doing More with Less in the Public Sector: A Progress Report from Madison, Wisconsin.* Madison, WI: University of Wisconsin-Madison, Center for Quality and Productivity Improvement.

4-2   Fargher. Jr., J. S. W. (Undated). *Updating the Plan for Quality and Productivity Improvement.* Cherry Point, NC: Cherry Point Naval Aviation Depot.

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4-1

Doing More with Less in the Public Sector: A Progress Report From Madison, Wisconsin

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CENTER FOR QUALITY AND PRODUCTIVITY IMPROVEMENT
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Report No. 13

DOING MORE WITH LESS IN THE PUBLIC SECTOR:
A PROGRESS REPORT FROM MADISON, WISCONSIN

William Hunter, Jan O'Neill*, and Carol Wallen*

June 1986

PRACTICAL SIGNIFICANCE

These days there is a considerable amount of discussion of new ideas for improving quality and productivity in organizations and the need for a complete transformation of the way these organizations are managed. Such discussions are almost always couched in terms of organizations in the private sector. There are compelling reasons for believing that significant improvements in quality and productivity can also be made in organizations in the public sector. This report describes some experience gained in city and state governments in Madison, Wisconsin, in using these new methods and provides some practical guidelines for getting started elsewhere.

Key Words: Quality improvement; Productivity improvement; Public sector; Case studies; New management philosophy; Human resource management; Scientific method; Statistical techniques; Process improvement; Problem-solving; Teamwork.

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DOING MORE WITH LESS IN THE PUBLIC SECTOR:
A PROGRESS REPORT FROM MADISON, WISCONSIN

William Hunter, Jan O'Neill*, and Carol Wallen*

Introduction

In the past decade, the City of Madison's Motor Equipment Division lost
six staff positions (down from 35 to 29), while the number of vehicles it
serviced grew from 546 to 725. Just this year, state agencies in Wisconsin
were directed to slash 7.7% from their operating costs because a slower-than-
expected economy had led to a projected $350 million revenue shortfall.
Across the country, belt-tightening is now the rule in the public sector as
the growth rate of tax revenues drop and services are shifted from the federal
government to state and local levels. Whatever the reason, public
administrators are being asked to "do more with less"—to maintain, or even
increase productivity in the face of budget and staff cuts.

How can the public sector begin to cope with this pressure?

In this article, we examine projects in Madison's city government and in
the state's Department of Revenue to show how the employees in these
organizations learned how to improve productivity by focusing on quality.
Managers started these efforts approximately two years ago. Their successes
and struggles illustrate the basic elements other managers need to consider—
how to get employees working together, how to gather and use data, and how to
avoid certain pitfalls. After describing a project that decreased downtime in

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a municipal garage and one that eased the backlog of typing requests in a state word-processing office, we will offer our reflections and some guidelines for doing more with less.

The key idea is to compensate for dwindling financial resources by getting the most out of human resources (see Figure 1). Some state and municipal leaders have boldly allocated portions of their dwindling budgets to educate themselves and their employees in the basics of quality improvement methods advocated by W. Edwards Deming, Kaoru Ishikawa, Joseph M. Juran, and others. People in their organizations are learning how to work smarter—not harder.

Quality improvement, whether in public or private sectors, demands three major changes: First, it calls for a total transformation of management philosophy in order that all employees can focus on the never-ending improvement of quality. Second, quality improvement means making decisions based on data, not just on hunches and guesses. All employees must scrutinize all key processes in the organization to determine where and how they break down, and how they can be improved. Third, improving quality requires an almost fanatical devotion to customers. The goal is to meet—and preferably exceed—customers' needs and expectations.

Traditional American management philosophies have become obsolete. Most managers in this country have been taught how to control rather than lead (Joiner and Scholtes, 1986). They give the direction and establish the controls that everyone else follows. This entrenched management style, developed in the mid-1800s, is—surprisingly—the last real innovation in American management. Well over a century later we're still using methods developed with the help of the military by railroad barons, the first managers of large, complex business organizations in this country (Chandler, 1977, and Scholtes, 1986).
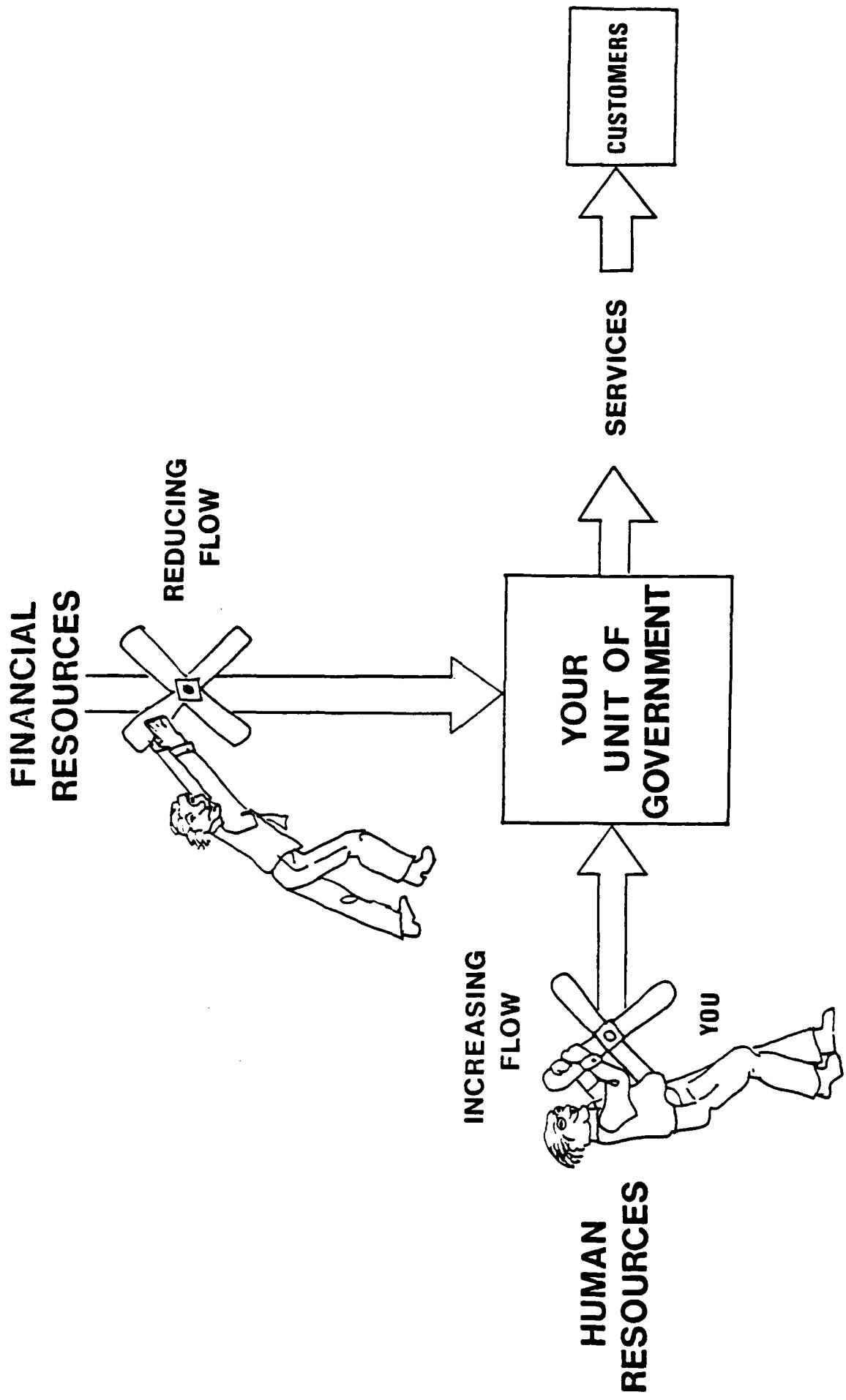
Figure 1. Compensating for decreases in flow of financial resources by increasing flow of human resources.

The most destructive feature of management by control, with its militaristic overtones, is the fear it engenders and on which it depends. Commands and information flow one way—from the top down—inhibiting employees lower on the ladder and discouraging them from contributing their ideas and talents. After all, how often does a general listen to a private? It is essential that fear be removed from the workplace. Then employees can begin to feel comfortable in using their creativity and talents to solve problems.

Fear, however, is just one of the problems caused by traditional management practices. Managers typically focus on the final product or service. In the public sector this focus translates into a reliance on audits, reviews, and hearings: attention that comes too late, allowing resources to be wasted on error-inspection rather than error-prevention. (For example, McDonnell Douglas was subject to 6000 separate government audits in 1985— meaning three new audits started every hour of each working day that year!)

Plans to increase productivity also go awry. When quality is only a secondary focus, managers typically try to get more for their dollars by either cutting costs or increasing quotas and exhorting their employees to work harder. The end result is the exact opposite of the goal: slashing funds or raising quotas almost always causes a drop in quality, which in turn means more rework and discouragement for the front-line workers. Productivity begins to fall, and managers get trapped in the blame game—"Who's at fault? Can't you work harder?" Since employees have no control over this situation, they tend to disassociate themselves from their work, no longer taking pride in the quality of what they do.

One requirement for changing these damaging management practices is to permit employees to take pride in their work. They need to become involved in making decisions, and their contributions need to be acknowledged. Managers

and workers need to become team members who are all pulling in the same direction.

But employee involvement alone is not enough. A second requirement for all employees and managers is to use a scientific approach for improving processes and solving problems. Data can be collected and analyzed by teams of managers and employees working together to reduce—and ultimately prevent— problems. To learn how to do this work requires considerable training.

Even teamwork and a scientific approach are insufficient to transform old-style management practices. The final key requirement is to build quality into every step of every process, from design to execution.

Nothing is perfect; processes can always be improved. Quality therefore demands continuous, never-ending attention. Closer attention must be given to internal customers, the people within the organization who are the recipients of products produced by co-workers, and to external customers, the ultimate beneficiaries of the work being done. Who are they? What do they want? The answers to these questions will point the way to quality improvement.

What happens when the primary focus is on quality? As quality improves, the amount of rework and repair drops, and employees are able to use their time more effectively. This approach leads to an increase in productivity and a drop in costs. To show how this focus on quality has worked in the public sector, we next summarize two examples.

QUALITY IMPROVEMENT IN ACTION

First Street Garage (Municipal service)

In November 1983, a Madison city audit highlighted poor productivity, labor-management relations, and inter-departmental communications in the Motor Equipment Division of the city's Department of Public Works. Efforts to improve the situation had repeatedly failed in the past. The auditors recommended they use some quality improvement techniques in the division.

A few months earlier, David E. Miller, an aide to Mayor F. Joseph Sensenbrenner, had attended a seminar organized by the University of Wisconsin-Madison and presented by W. Edwards Deming. Recognizing that Deming's mandate for quality improvement was as true for governmental agencies as it was for industries, he convinced the mayor and city council to appropriate a portion of the 1984 budget for instruction in and trials of Deming's approach.

Peter Scholtes, a city employee who was a specialist in organizational development, learning of the audit's recommendation and of Miller's budget proposal, combined the two and began a push for getting this new management approach used at the First Street Garage (the primary facility of the Motor Equipment Division). With additional support from Miller and Mayor Sensenbrenner, the program was up and rolling by March of 1984.

Initially, four employees from the Motor Equipment Division met with Peter Scholtes, and later also with Bill Hunter, a professor from the University of Wisconsin-Madison. The team spent the first meetings learning the fundamentals of quality improvement. They initially proposed "morale" as a problem that desperately needed attention, but Scholtes suggested that if they stuck with more concrete targets, morale would probably take care of itself. Heeding this advice, the team chose to focus on two areas: customer research and causes of vehicle downtime. With the addition of several other employees, they then split into two separate groups.

The customer research team interviewed supervisors in five "user" agencies and surveyed other agency employees and managers by mail using a random sample. Through another survey of the above groups, the city's common council, and the Board of Public Works, the customer research team was able to rank repair priorities.

Since the customer research team was convinced the surveys would be an open invitation to criticize the division unmercifully, they approached their

tasks with some trepidation. The customers rated the overall quality of Motor Equipment's service above the employees' expectations, which resulted in a boost to the employees' morale. Another surprise for the employees was that "safety" appeared at the top of every customer's priorities, not "repair costs" as had been assumed (repair cost ranked sixth out of seven possible answers). Employees at the First Street Garage were glad to learn of this result because they had long felt dissatisfied when they were forced by the "hurry-up" atmosphere to put vehicles back into service that they judged to be unsafe. As expected, customers identified the division's biggest problem as "duration of downtime."

Even before these surveys were finished, the downtime group had begun its task. What in their process caused long repair delays? The team flow charted the entire process, defining fifteen steps from the time a vehicle was brought in until it was put back in use (see Figure 2). These steps were then listed on checksheets which were subsequently used by the division to track equipment passing through the garage over a one-month period. The check- sheets helped the team to see how long each step took by type of vehicle, customer, and repair priority.

The team then examined these checksheets. They discovered that 28% of a low-priority vehicle's time was spent in the lot waiting for repairs to begin. Further, about 15% of all vehicles' time in the garage was spent waiting for parts to be delivered. Some of this latter delay was caused by problems in Motor Equipment's "parts" room, but since the system was being computerized, the group was convinced they should wait until the conversion was complete before tackling the parts problem.

At this point many teams would have moved immediately to start looking for solutions. (Tempting as it may be, such an approach is often inefficient in the long run.) The Motor Equipment team, however, guided by Scholtes and
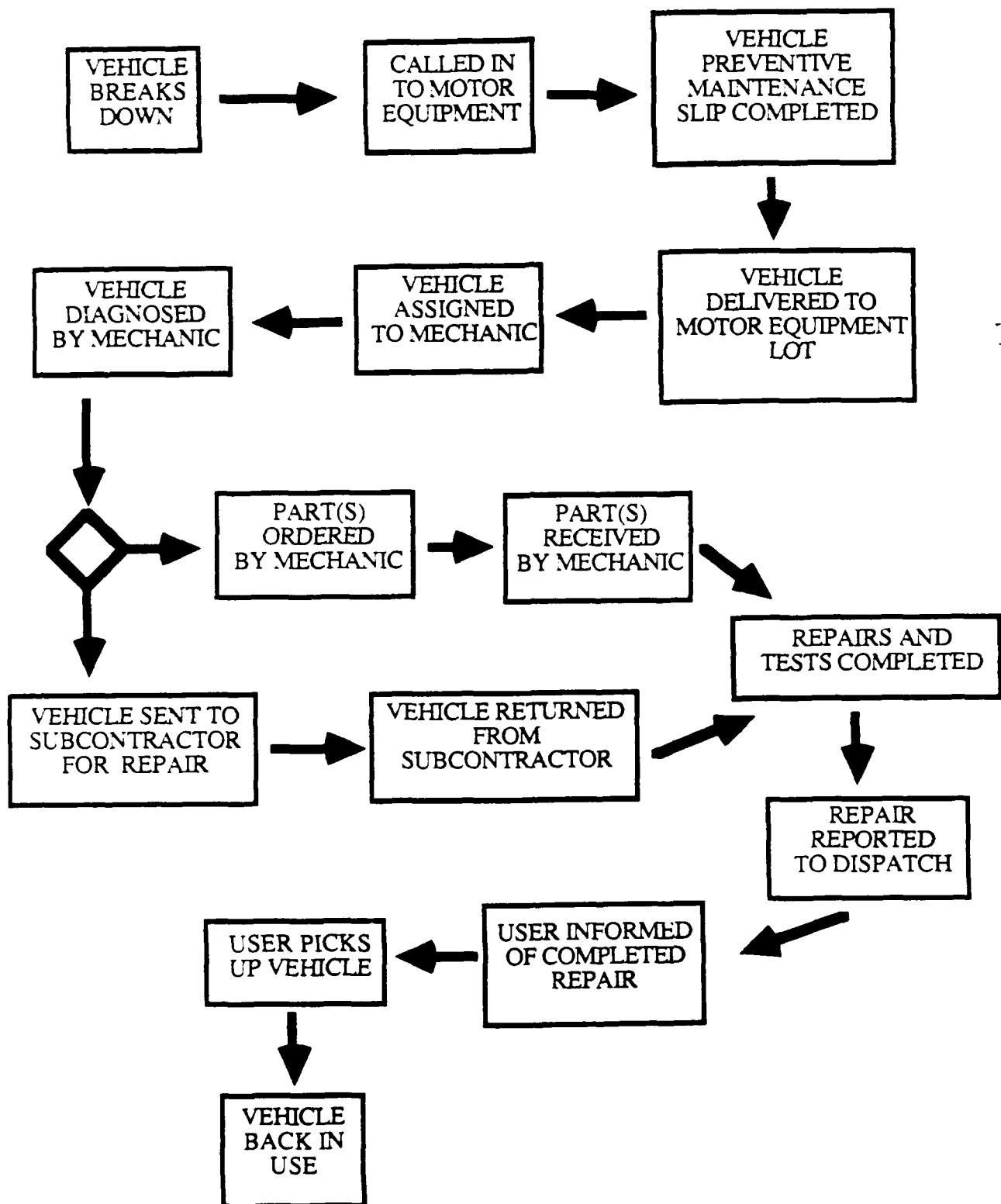
Figure 2. City of Madison Motor Equipment Division
downtime flow diagram for repair of vehicles.

Hunter, decided to dig for underlying causes of excessive vehicle downtime. They found that: (1) vehicles were being replaced on the average less frequently than a decade ago (every 21 years for non-police vehicles now vs. every 10 years before), and thus the fleet was aging rapidly—based on the fact that, for example, approximately 5% of the fleet was currently being replaced each year; (2) the division had lost six staff positions during a period when the fleet had grown enormously; and (3) other agencies, also suffering staff cuts, had been buying "high-tech" equipment that required fewer operators but was more expensive to repair and maintain. To make matters worse, for the past two decades the division had operated under an "if it ain't broke, don't fix it" policy handed down from the early 1960s. Minor problems, therefore, had to become major before they could be handled.

With these and other carefully documented facts to support their case, the mechanics personally persuaded the City Council and the Mayor to reinstate a preventive maintenance program deleted from the City budget twenty years before. The mechanics predict savings will grow and downtime will decrease as small problems are caught early.

The downtime team recommended other steps that helped reduce downtime. They had their customers develop a "repair priority" list (which repair jobs take precedence?), they established agency contacts to facilitate communications, and they streamlined repair procedures.

However, it is painting too rosy a picture to imply every employee is now "on board," and every customer satisfied. Some employees not on the project teams were unhappy about being excluded and having to pick up their colleagues' work when those team members met. (To alleviate this problem, more people have been either added to project teams or encouraged to join future teams.) The division has also had to deal with resentment from customer agencies whose vehicles are now designated as low priority. Making

decisions about priorities—and sticking by them—has often put Motor

Equipment personnel in tough spots.

Word Processing Pool (State service)

Imagine sending a one-page letter to a word-processing pool and getting

it back two or even three weeks later—with errors. Now imagine coming to

work each day and having to face an entire wall of floor-to-ceiling shelves

packed with a backlog of typing requests. Such was the dismal reality faced

by customers and operators of the Compliance Bureau of the Wisconsin State

Department of Revenue. They tried countless adjustments, but the turnaround

time stubbornly remained at unacceptably high levels. Communication and trust

kept deteriorating and employee turnover rates continued to rise.

In June 1985, the Department of Revenue began its first wave of quality

improvement projects, and the word processing problem was a main target. Nine

people participated on a quality-improvement team: the Bureau Director (now

Division Administrator), three section chiefs (representing the "customers"),

the word processing supervisor, three operators, and a systems analyst. The

team met weekly for three months.

The first meeting broke new ground for all team members. It was the

first time operators had sat down with managers to analyze word processing

tasks and to identify all their customers and suppliers. To maximize

individual input, the team completed a nominal group exercise (Delbecq, Van

de Ven, and Gustafson, 1975): brainstorming problems, then listing, discussing

and clarifying ideas, and eventually ranking problems in order of importance

(see Figure 3). Since all team members ranked "low quality" as the number one

problem, the team mapped the possible causes of poor quality on a cause-and-

effect diagram, as shown in Figure 4 (Ishikawa, 1982). The primary problems

in their jobs were illegibility, missing information, spelling, punctuation,

grammar, missing signature, and repeated use of a single form for different
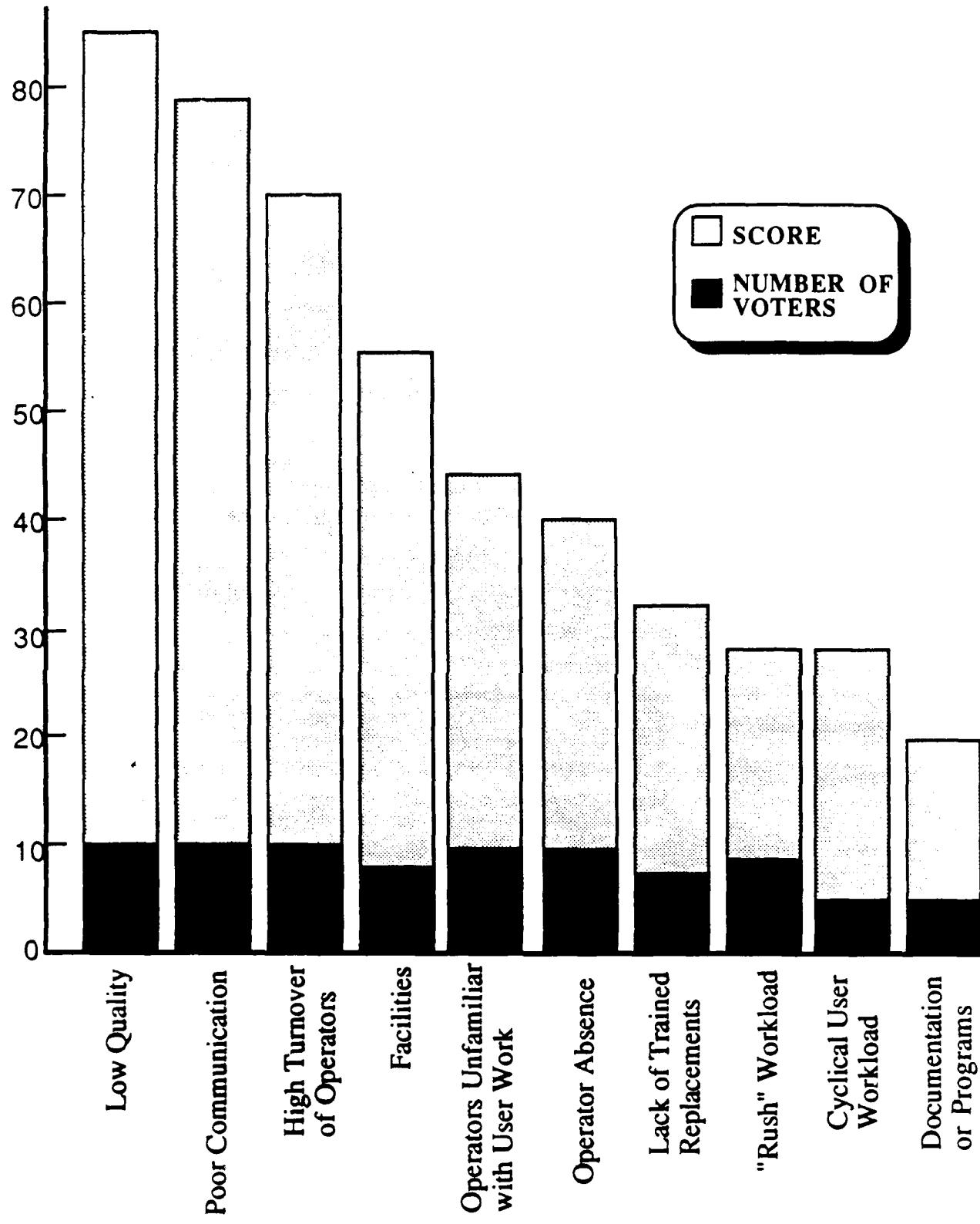
Figure 3. Pareto diagram for nominal group results of Wisconsin State Department of Revenue word processing team.
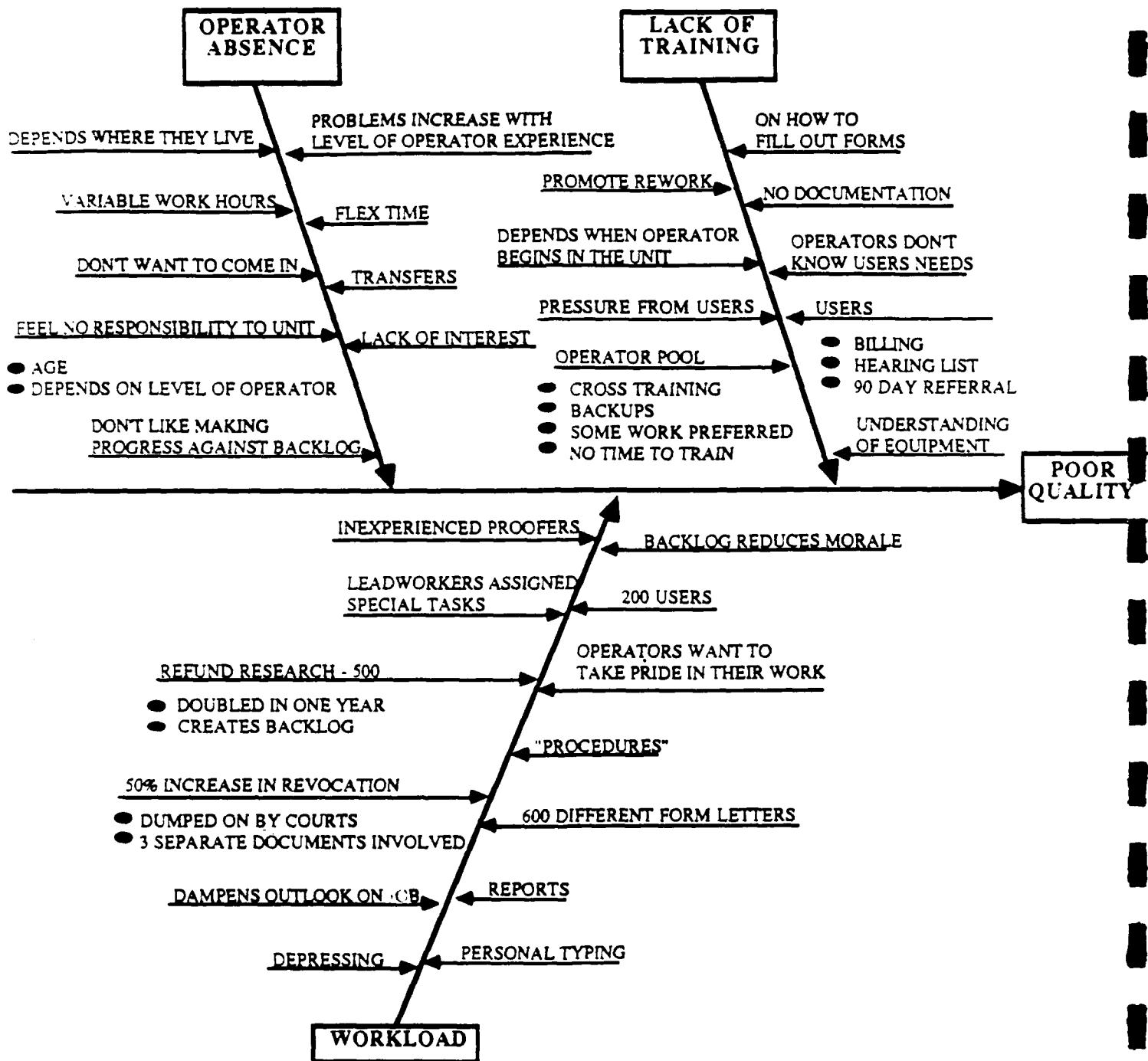
Figure 4a.   Wisconsin State Department of Revenue word processing team
cause-and-effect diagram showing operator absence, lack of
training, and workload as the major causes of poor quality.

COMMUNICATION

ERRORS, QUESTIONS, PROBLEMS

FORMS-TYPING REQUESTS

USERS
- GO TO SUPERVISOR
- GO TO OPERATORS

OPERATORS
- GO TO SUPERVISOR
- GO TO USERS (LOSE PRODUCTION TIME)

- RE-USE SAME FORMS
- ILLEGIBILITY
- NO USER MANUAL
- NO UP-DATED DIRECTIONS

- MISSING INFORMATION
- USER CODES
- DON'T USE THEM
- EACH UNIT HAS DIFFERENT ONE

WORD PROCESSING SUPERVISOR
- GOES TO USER
- GOES TO UNIT SUPERVISOR

LACK OF COOPERATION

NO SINGLE UNIT CONTACT

"RUSH"
- OVERUSE
- INAPPROPRIATE USE

OPERATORS RESPONSIBLE FOR 600 DIFFERENT DOCUMENTS

POOR QUALITY

PROOFING

OPERATORS ARE NOT FAMILIAR WITH USERS WORK

USERS SNAP AT OPERATOR FOR ERRORS

PRODUCTION LOG UNFAIR

DON'T KNOW USER NEEDS AND EXPECTATIONS

ABSENCES
- SICK
- VACATIONS
- LEAVE WP UNIT

LACK OF UNIFORMITY IN USERS FROM SAME UNIT

DIFFERENT LEVELS OF ABILITY

QUESTIONS REMOVE OPERATORS FROM PRODUCTION

MISTAKES ON SEQUENTIAL FILES

OVERUSE OF "RUSH" CAUSES GRUDGES

DON'T LIKE POOL OF OPERATORS

LACK OF UNIFORMITY IN UNITS

VARIABLE WORKLOADS

REFUSAL TO CHANGE

CODE MANUALS ARE TIME CONSUMING

ANGRY
- PERSONAL PROBLEMS
- NO DISCUSSION OF PAST ERROR

INFORMATION
- INCOMPLETE
- IMPROPER
- NO PROCEDURES
- FORMS INADEQUATE

"OVERUSE OF RUSH"
- SOME AREN'T THERE TO ANSWER QUESTIONS ON THE REQUEST
- BACKLOG-WANT REQUEST FAST
- ARTIFICIALLY ESTABLISH DEADLINES

PRESSURED FROM OUTSIDE OR TOP MANAGEMENT TO GET A JOB DONE

REFUSE TO USE STORED PARAGRAPHS

OPERATORS

USERS

Figure 4b. Wisconsin State Department of Revenue word processing team cause-and-effect diagram showing how communication, operators and users affect poor quality.

typing requests. This request form was the crucial link between customers and operators, and when the forms were improperly filled out, operators had difficulty ascertaining what the customers really wanted. The result was product of poor quality.

To pinpoint where problems were occurring, the team broke into two groups (customers and operators evenly distributed in each group). Each drew a flow chart for the entire process. These two were merged into a single flow chart, which proved to be an excellent vehicle for communication. The team used the chart to focus discussion on specific points. From these discussions, the team decided to collect two types of data. The section chiefs conducted a customer survey to find out what the users wanted and expected; the operators developed and used a checksheet to track each work order as it passed through the word processing unit so they could locate where different kinds of errors occurred.

The results of the customer survey indicated that collectively the users estimated that they submitted about 2900 documents per week to the pool and that about 18 percent of the documents contained errors when first returned. These customers ranked the pool "adequate" on overall quality (see Figures 5 and 6), and further indicated quick turnaround time, accuracy, completeness, and correct format were highly important "quality" characteristics.

Using checksheets, the operators gathered data for two weeks. They noted times in and out for all documents, sources of requests, and problems encountered. Over these two weeks the actual workload was about 7900 documents (from over 1900 requests)—or over 35% more documents per week than the customers had estimated. Moreover, the time covered was a slow work period! Of the 1900 typing requests, 27% had errors caused by the customers. (For a breakdown of errors see Figure 7.)
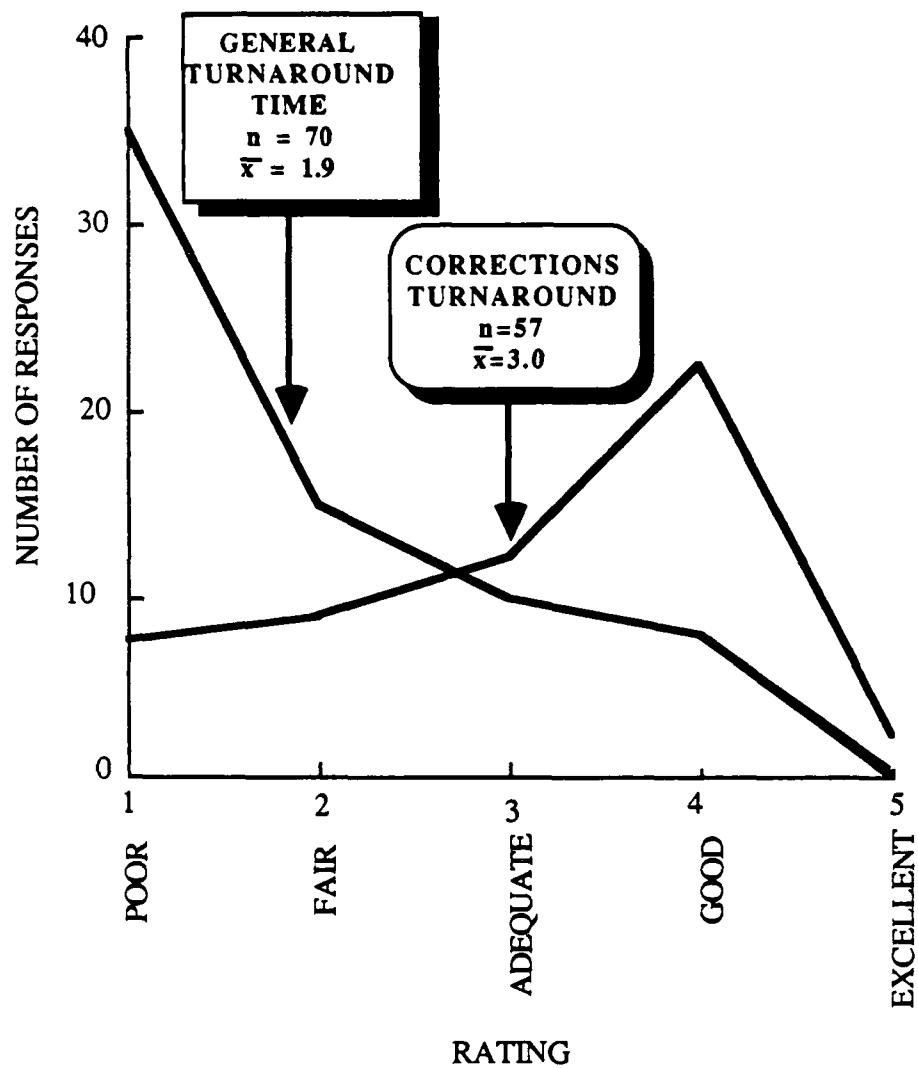
Figure 5. Wisconsin State Department of Revenue word processing
customer survey (n = number of responses and $\bar{x}$ = average rating):
general turnaround time and corrections turnaround.
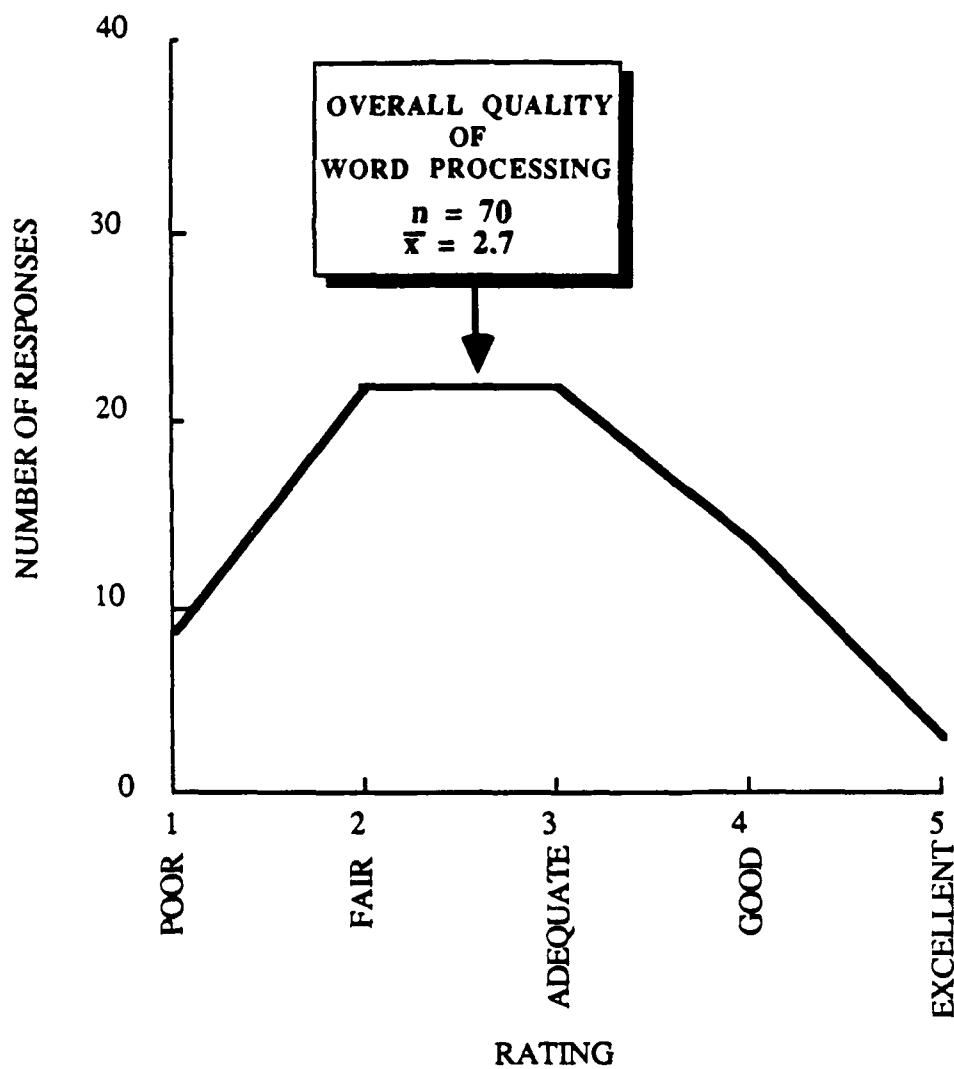
Figure 6. Wisconsin State Department of Revenue word processing
customer survey (n = number of responses and x̄ = average rating):
overall quality of word processing.
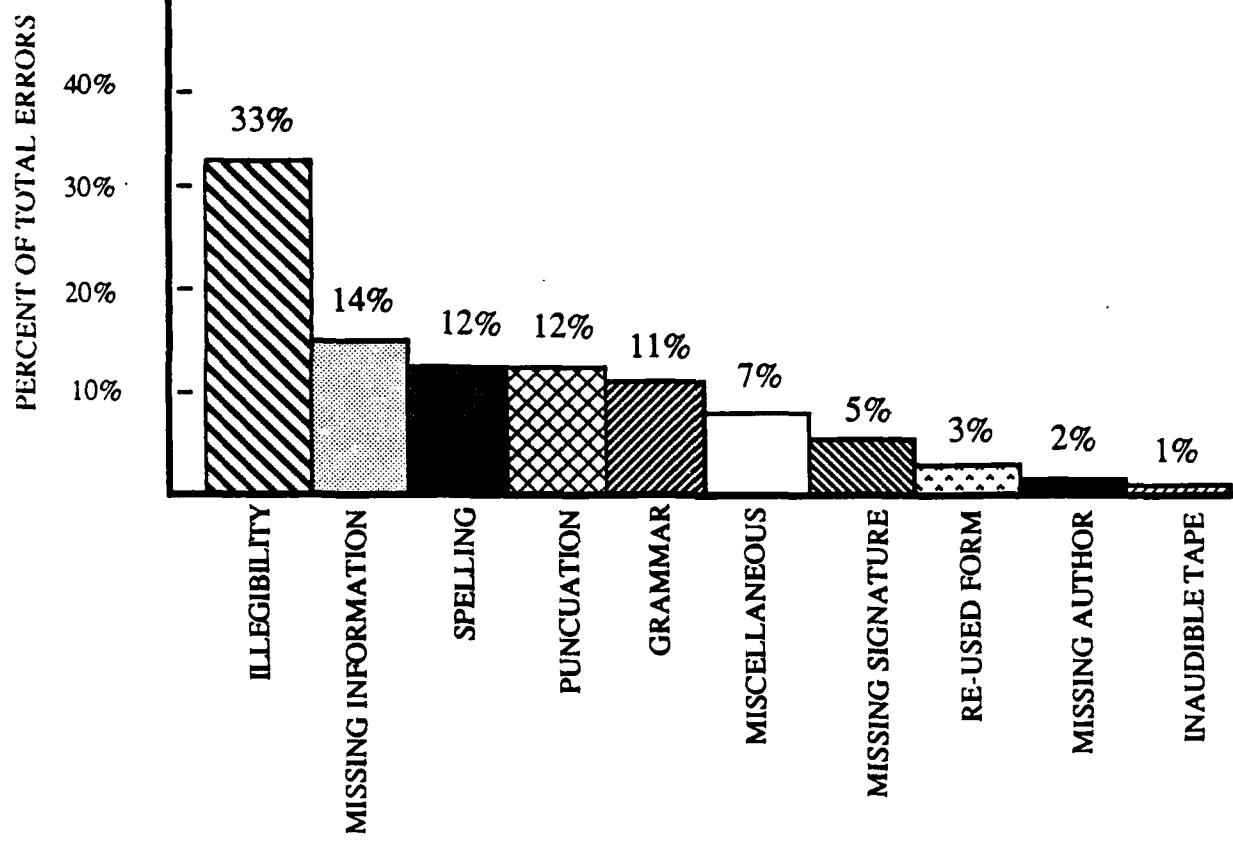
Figure 7. Wisconsin State Department of Revenue word processing team
data on types of errors.

In subsequent weeks, the team segregated typing requests into REGULAR and RUSH piles and examined the flow of work by customer unit. They found that 49% of all typing requests were designated RUSH when submitted, with one unit alone accounting for more than half of that total. This unit's employees, fearful they would miss a legally mandated 15-day turnaround for correspondence, marked all requests RUSH. These requests clogged the normal channels, and were in fact one of the primary causes of the two to three week turnaround time.

With data in hand, the section chiefs enacted a requirement that the RUSH designation be used only for documents needed within two days. They also monitored the RUSH baskets to prevent customers from undercutting this new policy. At the same time, word-processing operators were given the authority to reject illegible or incomplete requests. Another essential step was allowing the operators to work overtime on two Saturdays to eliminate the backlog. The team was further able to reduce the workload after an inventory they took of typing requests showed the pool was handling requests that should have gone to other units. This inventory also helped customers and operators anticipate peak workload periods.

Following these changes, the turnaround time quickly decreased to two days, reaching (and staying) at eight hours soon thereafter. (Recall that the original turnaround time was two to three weeks.) The customers and operators continue to meet voluntarily once a week to continue the improvement process.

REFLECTIONS: PATTERNS SEEN, LESSONS LEARNED

The initial successes in the Motor Equipment Division and Department of Revenue have inspired many other municipal and state agencies in Madison to give quality improvement techniques a try. In the City of Madison and the Department of Revenue themselves, much additional activity has taken place.

Most, but not all, projects have been successful. We've learned valuable lessons by comparing the more successful projects and project teams with those that were less successful.

More progress has been made by teams with some or all of the following ingredients.

Selected projects—

- were clearly linked to customer needs
- were important to the employees
- were manageable, neither too large nor too small
- concerned processes responsive to changes
- focused on statistically measurable processes rather than on policies or attitudes

Selected teams—

- included line-workers who had hands-on experience with the studied processes
- had supervisors and managers committed to quality improvement
- included union representatives when appropriate
- became enthusiastic about their participation, and communicated this enthusiasm to employees not on the team
- were guided and coached by neutral third-party "facilitators" who were able to keep teams focused on the data and underlying causes of problems

Let's take a closer look at each of these ingredients.

Madison's Motor Equipment Division and the State Department of Revenue's Word Processing Unit knew their customers and employees were unhappy, and that line supervisors were caught in the middle. Motor Equipment's customers complained about having to wait weeks or months for repairs. In the word processing unit, the operators and supervisors had endured years of complaints from all of their customers. The supervisor was involved in daily "fire-fighting" as she sought to smooth out problems created by long turnaround times.

Both of these project teams selected manageable projects. Neither team attempted to tackle diffuse or broad problems. They correctly viewed projects

such as "communication" or "worker morale" as too complex and abstract, and as symptoms of other, more direct causes. They avoided taking aim at only small pieces of the larger problems, such as equipment shortages or grammatical errors.

Furthermore, both downtime and turnaround time are easily measured processes that are responsive to change. The records kept by the Motor Equipment mechanics and the operators in the Department of Revenue helped these employees to isolate problems by comparing lapsed time for the steps in their processes. Their data also allowed them to strike at the real causes of problems. Having eliminated the causes, they could take steps to prevent future problems, thereby improving the process as a whole.

The composition of these teams also contributed to their success. Terry Holmes, the president of the local labor union, was crucial in motivating the Motor Equipment mechanics, assuaging their fears, anticipating potentially troublesome situations, and taking steps to resolve them ahead of time. The word processing team was a mix of line workers and supervisors daily involved in the process being studied, and of customers, resulting in a rich flow of useful information the Bureau had never before had available.

Another factor was the knowledge, commitment, and involvement of these agencies' top managements. Revenue's Secretary Michael Ley, Deputy Secretary Eileen Mershart, and Madison's Mayor, F. Joseph Sensenbrenner, have all made extensive efforts to educate themselves and others in the new philosophy and its tools and techniques. They have communicated their commitment in word and action, and are seeking to create an organizational atmosphere free of the fear of failure. Once the Department of Revenue's projects had been completed, Secretary Ley held an all-day senior management retreat in order to begin developing a collective vision of what the department should look like

in the future. Mayor Sensenbrenner also met with his managers to review a quality improvement implementation plan in December 1985.

These top managers' commitment has encouraged other managers naturally inclined toward this approach to emerge. Lee Cheaney, Revenue's Bureau Director of Inheritance and Excise Taxes, is now leading his bureau using the quality improvement style and methodology. Other departments are beginning to contact Cheaney for help in getting teams started. Madison Police Chief David Couper has always felt comfortable with participative management, and he now has a viable framework within which management and project teams can more scientifically do their work. Other departments throughout the city and state are now seeking information and hoping to get involved.

The final important ingredient is guidance by neutral third parties. Skilled at team-building, unencumbered by group power dynamics, the outside facilitators on the Motor Equipment and Department of Revenue teams were also well-versed in quality improvement philosophy, goals, and methodology. Through their guidance, teams stayed focused on customers' needs and the causes of problems, teams let the data do the talking, and they gained valuable education and skills in the process.

What of other, less-successful projects? What went wrong? Again, some common patterns emerge. If team members were either unwilling to speak up or inclined to dominate, communication and information flow halted. If customers and other co-workers were neither surveyed nor interviewed, teams found themselves running in circles, unable to focus on root causes and concrete problems because they didn't know what their customers wanted. When teams chose a "fuzzy" issue or abstract process to study, the sheer complexity caused months of wheel spinning. On the other hand, if teams tackled relatively insignificant projects, they sometimes felt deflated after solving

the problem: "You mean it was that simple?" For these teams to reap any benefits, it was important for them to step back periodically and ask, "What do we know now that we didn't know before?" Otherwise frustration, conflict, and boredom could set in.

BASIC GUIDELINES

How do the examples described above fit within the larger context of quality improvement strategies?

The processes studied and improved involved front-line workers. Higher-level processes such as preparing budgets and making policy can also be studied and improved. Teams in such instances will be composed of senior managers.

A key step toward quality and productivity improvement is to open all lines of communication: between managers and employees, between an agency and the people who use its services and whose services it uses, between the various units in an agency. The result will be a flow of ideas and creativity—tapping into human resources—that will allow agencies to improve services without having to increase the flow of financial resources.

"Looks good on paper," one might be thinking, "but I can't just open up those floodgates. How could I handle all those ideas?"

The traditional structure of organizations leaves people ill-equipped to deal with this creativity. As seen in the above examples, employees had to be given new tools and a new framework in which to act. The most powerful tools are scientific methods, the most effective of which are easy to learn. Statistical methods, for example, allow people to learn from data: how to collect data most efficiently and how to extract useful information from data once they have been collected.

Yet statistics and other scientific tools are no panacea. Their power can remain unrealized in cramped environments. Only when combined with open communication and an obsession with meeting customer needs can these tools be used effectively. Data cannot be gathered without widespread cooperation and teamwork.

Top management must take the lead here by creating an open, collaborative climate. Otherwise employees may be hesitant to collect data on work they are doing because of the fear that such information will be used against them or their co-workers. They may worry that, if gains in productivity are realized as a result of such activity, some of them may lose their jobs. Consequently, management methods in most organizations must be drastically overhauled to change the atmosphere from one of fear to one of trust. The idea of collecting data is not to blame and criticize individuals but rather to improve all processes and systems within the organization.

When top management removes barriers, employees at all levels will be encouraged to learn techniques for effective use of technical and human resources. This re-education process—developing a united team, a scientific approach to problem-solving, and unrelenting focus on customer and quality—is hard work.

As Madison's leaders are discovering, a large portion of the learning comes by doing. Their projects can serve as models for projects elsewhere. To help other public administrators get started, we offer the following guidelines in nine steps that represent the best features of the projects we've observed (see Figure 8). This nine-step sequence need not be followed in a lock-step fashion. Depending on circumstances, some modifications may be desirable.

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┌─────────────────────┐      ┌─────────────────────┐      ┌─────────────────────┐
│        - 1 -        │      │        - 2 -        │      │        - 3 -        │
│ CONDUCT NOMINAL GROUP│ ───▶ │  OUTLINE THE PROCESS │ ───▶ │ DRAW CAUSE-AND-EFFECT│
│ TECHNIQUE EXERCISE  │      │    STEP BY STEP AND  │      │  DIAGRAM FOR SELECTED│
│                     │      │    DRAW FLOW CHART   │      │       PROBLEM        │
└─────────────────────┘      └─────────────────────┘      └─────────────────────┘
                                                                     │
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┌─────────────────────┐      ┌─────────────────────┐      ┌─────────────────────┐
│        - 6 -        │      │        - 5 -        │      │        - 4 -        │
│   PLAN CHANGES      │ ◀─── │   ANALYZE THE DATA   │ ◀─── │    COLLECT DATA     │
│    TO BE MADE       │      │                     │      │                     │
└─────────────────────┘      └─────────────────────┘      └─────────────────────┘
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│        - 7 -        │      │        - 8 -        │      │        - 9 -        │
│   MAKE CHANGES,     │ ───▶ │    ANALYZE THE       │ ───▶ │  MONITOR CHANGES    │
│ COLLECT MORE DATA   │      │   ADDITIONAL DATA    │      │                     │
└─────────────────────┘      └─────────────────────┘      └─────────────────────┘
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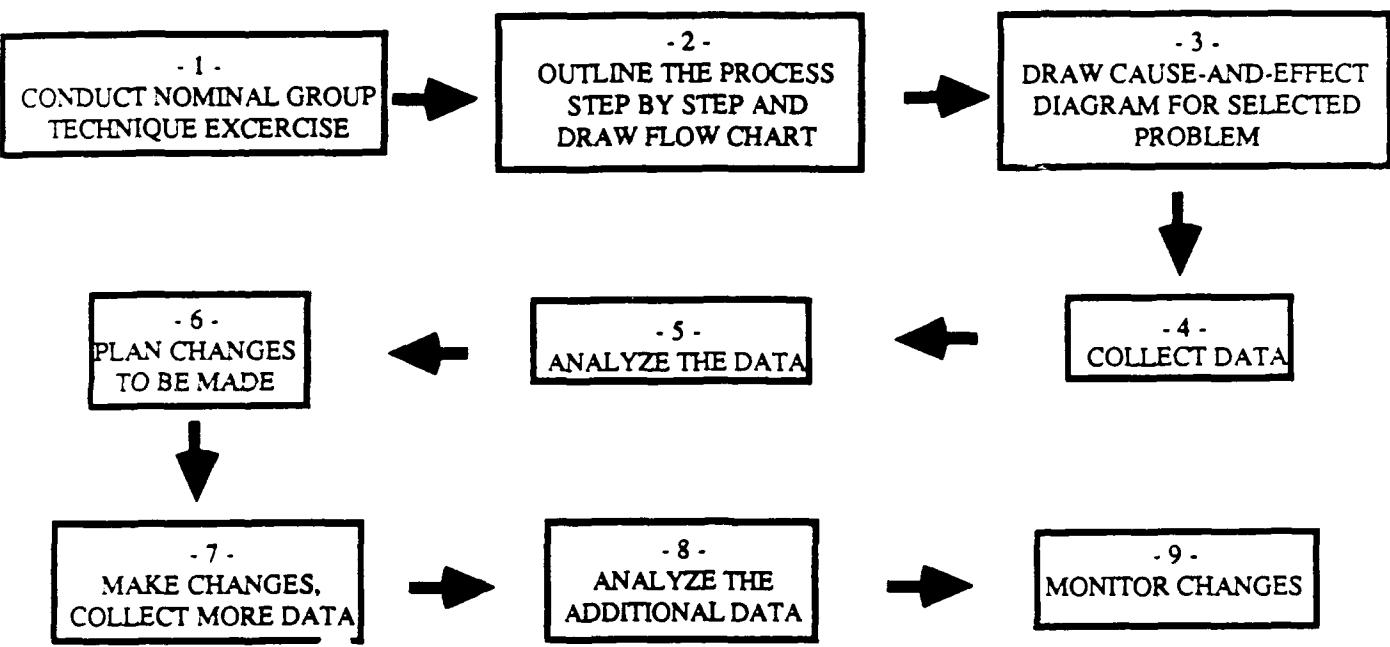
Figure 8. Guideline for getting started: a suggested
sequence of nine steps.

STEP 1: Conduct a Nominal Group   These sessions are structured meetings that
         Technique exercise   are extremely useful at the outset of a
                                           quality improvement project. The format
                                           allows teams to identify, through a voting
                                           process, a _vital few_ problems needing
                                           attention.

STEP 2: Outline the process   Flow charts are one of the simplest and
         step by step and draw   most effective techniques to use because
         flow chart.   they allow teams to understand the process
                                          on which they are working and to pinpoint
                                          where problems are occurring.

STEP 3: Draw a cause-and-effect   Like flow charts, cause-and-effect diagrams
         diagram for selected   are powerful yet simple tools. They enable
         problem.   teams to focus on possible _causes_ of
                                          problems. (Once a problem is isolated
                                          through the flow chart, a cause-and-effect
                                          diagram helps identify the exact kind of
                                          information that needs to be collected.)

STEP 4: Collect data.   If the team has followed the above steps,
                                          it should have some idea of _where_ problems
                                          are occurring and what kinds of data are
                                          needed to find the actual causes of
                                          problems.

STEP 5: Analyze the data.   Analyzing data also varies according to
                                          specific situations. Most often, however,
                                          simple techniques can reveal patterns in
                                          the data and point the way towards
                                          solutions. Pareto charts, bar charts, dot
                                          diagrams, and trend plots are particularly
                                          useful.

STEP 6: Plan the changes.   What skills or resources are needed to make
                                          the changes indicated as necessary by the
                                          data? Who will do the training? By what
                                          steps will the changes be introduced into
                                          the old system?

STEP 7: Make changes, collect   Carry through with planned changes _while_
         data.   _continuing to collect data_. This way the
                                          team will be able to assess the effective-
                                          ness of the changes.

STEP 8: Analyze the additional   Analyze the data on the altered process.
         data.   Did the changes help? If the changes did
                                          not help, try to find out why. Go back to
                                          flow chart and cause-and-effect diagrams.
                                          Was the process assessed correctly in the
                                          first place? Are there factors left out of
                                          initial considerations? Decide on a course
                                          of action and begin again at an earlier
                                          step.

STEP 9: Monitor changes.

Did further changes the team make have desired effects? Did problems arise on a broader scale when changes were implemented? Did other aspects of the problem surface? This analysis should point out how the process can be improved further. Since quality improvement is a never-ending process, the team will probably pick up the loop again at an earlier stage. How far back it goes will depend on how different subsequent problems are from the original one. The team may need to draw up new flow charts and cause-and-effect diagrams.

Keep in mind the philosophy behind the entire process of quality improvement.

Concentrate on these principles:

- The purpose of quality improvement is to meet, and if possible exceed, the needs and expectations of customers.

- A focus on quality as defined by the customers will result in increasing productivity and decreasing costs.

- Keep the communication lines open in all directions—customers, suppliers, and employees are all valuable sources of ideas and suggestions.

- At most, 15% of the problems in any process are within a worker's control. The other 85% or more are system problems, which only management has the power to correct.

- A long-range collective vision for where an organization is going is vital to the success of any quality improvement effort. Develop this vision with the help of managers at all levels. Begin working in management teams to articulate this vision.

- Think of quality improvement as a never-ending continuous process. Be forever obsessed with quality in order to keep improving.

- Learn gradually by doing; build your confidence.

Finally, remember that the core of quality improvement is utilizing human resources. American managers have tended to ignore them for too long, and they may not know where to begin. Our suggestion is to add the following four sentences to all job descriptions:

- Always be asking: "How can we make things better around here?"

- Ask: "How can we serve our customers better?"

- Ask: "What hassles, frustrations, and inefficiencies prevent me from doing my job as well as I would like?"

- Share the answers with colleagues, managers, suppliers, and as appropriate, customers.

The public administrators who are attempting to implement this new management philosophy in Madison are pioneers. Although this management style is firmly entrenched in many Japanese businesses, it has rarely been used in any Japanese public sector organizations. As far as we know, no other American government organizations are attempting to implement this approach in its entirety (although we'd be glad to be corrected on this point). Learning by doing takes time, patience, and courage—especially when there are few models to emulate.

Unfortunately, there are special problems inherent in the public sector. Long-term planning is extremely difficult to do. With one eye on re-election or appointment every two to four years, top management is faced with transforming an entire organization in an impossibly short time. The public may be quick to criticize when changes are slow, and public officials are often hesitant to take the necessary risks. Civil servants who enjoy long-term employment, however, may be able to keep quality improvement alive. There is the potential in this group for building what W. Edwards Deming calls "constancy of purpose" (Deming, 1986).

It takes courage for public leaders to commit themselves and their organizations to this approach. As one Japanese executive remarked, however, "You cannot afford to be faint-hearted about improving quality."

A PARABLE

Once upon a time in a tropical country, several people lounged under a bright, hot sun. Some swam in a nearby pool. A young man who happened by was entranced by what he saw. He had never been swimming, but it looked enticingly refreshing. After a few captivating minutes, the young man resolved to give this thing a try.

He must have thought it looked so easy. After all, these people just moved their arms and legs about in simple patterns.

Confident he knew what to do, the young man ran straight to the pool, jumped in ... and sank ten feet to the bottom. Fortunately, a woman had seen what happened. She dove in and hauled him out of the pool, where he was revived.

Like this young man, many of us hear about innovative management practices and think to ourselves, "How easy it all looks." We jump in without proper guidance and wonder where we went wrong as we sink to the bottom of the deep end.

There is much more to both swimming and quality improvement than meets the eye. The "visible pieces" are only part of the story. Some people reading about Madison's quality improvement projects may say, "It's really nothing new." They will look at their own practices or employee participation programs and think they have all the tools and methods they need; they've just never combined elements in the ways we've discussed. They're ready to imitate the success of others, envisioning quick and glorious results.

Unfortunately, they are as mistaken as the young man at the swimming pool. Quality improvement, like staying afloat, can become second nature, but it also takes education, patience, and practice before you can do it on your own. For quality improvement, a sweeping overhaul of attitudes and approaches is needed. Also required are commitment, energy, perseverance, and creativity. In mastering this transformation, America may again be able to proclaim advances in management. Public administrators who, to an even greater degree than their private sector counterparts, are frustrated by having to do more with less, can take the lead.

The references at the end of this article provide further details for readers who want to learn more. We would enjoy hearing from anyone about their successes and failures in shifting to this new style of management.

As a final note, what do the managers and workers have to say about the time and energy they have invested in these efforts? In Madison, one supervisor said about labor-management relations in his division: "It used to be us against them. Now it's just us." In turn, Joe Turner, a division foreman, observed, "Now there's less cussin' and more discussin'." Quality improvement can work in the public sector.

ACKNOWLEDGEMENTS

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REPORT LIST
August 1988

Report No.	Title/Author/Subject

1. **Studies in Quality Improvement: Dispersion Effects from Fractional Designs** by George Box and R. Daniel Meyer. The expense of repeating measurements can sometimes be avoided by using unreplicated fractional factorials to identify factors that affect variance and ones that affect the mean.

2. **An Analysis for Unreplicated Fractional Factorials** by George Box and R. Daniel Meyer. New procedures for analyzing unreplicated fractional factorial designs make them easier to use.

3. **Analysis of Unreplicated Factorials Allowing for Possibly Faulty Observations** by George Box and R. Daniel Meyer. Inaccurate data points are particularly troublesome in the analysis of unreplicated factorial experiments, but new techniques allow investigators to overcome this difficulty.

4. **Managing Our Way to Economic Success: Two Untapped Resources** by William G. Hunter. American organizations could compete much better at home and abroad if they would learn to tap the potential information inherent in all processes and the creativity inherent in all employees.

5. **My First Trip to Japan** by Peter R. Scholtes. American visitors to Japan can learn much about what it takes to successfully implement quality improvement.

6. **Total Quality Leadership vs. Management by Control** by Brian L. Joiner and Peter R. Scholtes. To survive in increasingly tough markets, top management in American companies will have to forsake their desire to "control" their employees, and instead learn what it means to provide Total Quality Leadership.

7. **Studies in Quality Improvement: Designing Environmental Regulations** by Søren Bisgaard and William G. Hunter. There is a surprising similarity between what SPC provides for industries and the need for constructing sensitive, reliable standards for environmental regulations.

8. **Studies in Quality Improvement: Minimizing Transmitted Variation by Parameter Design** by George Box and Conrad A. Fung. By properly designing products and taking the inevitable variation in components into account, engineers can minimize the amount of variation that ultimately shows up in finished products.

31. **Quality Improvement: An Expanding Domain for the Application of Scientific Method** by George Box. Sir Ronald Fisher's work on data analysis and experimental design made possible applications of scientific method to quality improvement in industry and everyday life. This paper discusses how quality improvement provides an expanding domain for scientific method.

32. **The Quality Detective: A Case Study** by Søren Bisgaard. A case study is presented that illustrates the practical problems of conducting experiments in an industrial environment.

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4-2

Updating the Plan for Quality and Productivity Improvement

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UPDATING THE PLAN FOR QUALITY AND PRODUCTIVITY IMPROVEMENT

by

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ABSTRACT

The initial efforts of the Naval Aviation Depot (NAVAVNDEPOT) to implement a total productivity program are described in an article entitled, "An Integrated, Proactive Approach to Planning and Measurement of Quality and Productivity - the Naval Air Rework Facility, Cherry Point, NC Case Study," recently published by the American Production and Inventory Control Society (APICS) in U.S. Success Stories in Manufacturing Productivity. The approach illustrated in this case study involves the process of strategic planning, implementation of Total Quality Management (TQM), and measurement by a Computer Integrated Manufacturing System (CIMS). Detailed examples are given. The strategic plans must be updated, the TQM efforts intensified and measurement techniques improved to continue the march toward attainment of higher quality and productivity levels. This paper describes the processes used to update the strategic plan to new business conditions, enhance and expand the TQM coverage, and institute both product and cost measures of achievement. Examples are also provided.

INTRODUCTION

The last several years has seen significant changes in the environment in which the NAVAVNDEPOT accomplishes its missions and functions. Recent initiatives to reduce cost and increase productivity have resulted in positive actions required by NAVAVNDEPOT management to not only manage better to gain better cost control but to analyze the various processes to streamline these processes so that fewer resources are required and quality improved. As a result of the Navy Industrial Improvement Program (NIIP), which is still ongoing, indirect staffing, material, and production costs have been reduced significantly. The Manage to Payroll initiative has required NAVAVNDEPOT managers to better manage their personnel expenses. Cost center budgets which allocate support costs to the product have made production managers much more cost conscious. Indirect managers are also being held fully accountable for expenses managed by their personnel as well as expenses incurred in the cost center.

The FY 87 Appropriations Act, at the request of the Department of the Navy, contained language that required the Navy to compete workload between organic

depots (NAVAVNDEPOTs and Navy shipyards) and commercial contractor. The purpose of this request by the Navy and legislation was to reduce the cost of depot overhaul and repair using competition as the tool. Competition may ultimately represent 10-17 percent of each NAVAVNDEPOT's workload. NAVAVNDEPOT Cherry Point responded by establishing a Business Office. Changes in the NAVAVNDEPOT culture and strategic/business planning were also evident as efforts focused on competition. Preparation of proposals, planning, technical marketing, cost control management, and a strong management organization to implement the workload are all issues being addressed in the name of competition.

Another change is the adoption and implementation of the TQM approach. Significant progress has been made in the implementation of TQM. Process analyses, as discussed above as a management improvement initiative, has been accomplished utilizing Process Action Teams (PATs). A complete TQM structure has been developed, Statistical Quality Control (SQC)/TQM-trained personnel are available, and employee participation in the TQM process has been accelerated. Productivity Gainsharing has also been initiated facility-wide, a first within the Department of Defense, to share the financial benefits of working harder and smarter.

Progress in the development of standard ADP/MIS/DSS systems, integration of new technology as represented by a leading edge local area network, Zenith-248 personal computers, host computers, and local programming to extract product and cost performance data has also affected the NAVAVNDEPOT. Management by data has become more prevalent as data extraction and trend analysis has become easier to accomplish and more readily available. The accounting system has moved costs closer to the product to obtain more nearly the cost of each product and to assign cost responsibility.

Finally, remembering our real customers - the Fleet - and the unscheduled deployments taking place because of events in the Persian Gulf and elsewhere around the world, the NAVAVNDEPOT must remain flexible to meet these commitments and maintain a mobilization base while still operating effectively and efficiently.

Strategic/Business Plan

The NAVAVNDEPOT at Cherry Point, North Carolina, formerly known as the Naval Air Rework Facility (NARF), has gone through two full cycles plus numerous other update efforts on the strategic plan. Rather than a third full cycle of the strategic plan, NAVAVNDEPOT Cherry Point changed the strategic planning process to a business planning process to, (1) mirror the Naval Air Systems Command (NAVAIR) corporate goals and objectives and the Naval Aviation Depot Business Plan, (2) recognize the changes to the environment to streamline operations and reduce costs by using business-like processes as being implemented in the NIIP, and (3) consciously change the process in recognition that the key to the success of the Depot Business Plan is the planning process itself. The long-range planning models as suggested by Coopers and Lybrand and Dr. D. Scott Sink were used as the model to develop both the Naval Aviation Depot Business Plan (NAVAIR level plan) and the NAVAVNDEPOT Cherry Point Depot Business Plan.

The Naval Aviation Depot Business Plan summarizes the key factors, identifies

the relevant issues, formulates strategies, develops courses of action, and charts the course for the Naval Aviation Depot community. Issued annually, this plan actually represents a year-round process that involves top management of the six NAVAVNDEPOTs, the Naval Aviation Depot Operations Center (NAVAVNDEPOTOPSCEN), and NAVAIR.

The NAVAVNDEPOT Cherry Point Business Plan (henceforth referred to as the business plan) was formulated by the top management of the NAVAVNDEPOT. These leaders are responsible and have the authority for implementing the business plan. These key individuals comprise the Executive Board, made up of the Commanding Officer, O Level Officers, and department heads.

Mission Statement

The first task of the Executive Board was to develop an updated mission statement reflecting the current environment and the sense of priority for mission functions. A situational appraisal of the internal and external environmental factors was conducted, listing factors that must be considered in the design, development, and implementation of the business plan. NAVAVNDEPOT Cherry Point's mission is:

To provide our nation with the highest quality depot level maintenance logistics support on time and at the least cost.

- We are a success when fleet squadrons prefer Cherry Point products and tell their friends.

- We are a success when we turn out better products at lower costs.

- We are a success when we can come to work with a sense of anticipation and relish.

This mission statement is to be reviewed and revisited with each iteration of the business plan.

Environmental Scan

In addition to the mission statement, the business environment was described by polling the members of the Executive Board using the Nominal Group Technique (NGT) illustrated later in the paper. From the varied perspectives of the Executive Board, the scan resulted in the following common observations of the business environment:

- NAVAVNDEPOT Cherry Point is a very complex business, specialized and highly technical. It is our challenge to inform all NAVAVNDEPOT customers and potential customers of the benefits of our services. We must communicate to our customers what our capabilities are, and the professional resources and methods we use to resolve their problems.

- NAVAVNDEPOT Cherry Point has entered into a very competitive world. We must compete for the scarce resources needed to do our job. The NAVAVNDEPOT has an obligation to conserve these resources and operate in the most efficient manner possible.

- NAVAVNDEPOT Cherry Point has customers with competing priorities. Some are concerned primarily with meeting schedules; others are more concerned with the economy of operations; and all are concerned with quality.

- NAVAVNDEPOT Cherry Point has a responsibility to remain flexible. We must adjust to changing peacetime requirements, just as we must be prepared to transition to any mobilization/wartime environment.

- NAVAVNDEPOT Cherry Point is a large and complex organization, and thus is subject to the classic problems incurred by such organizations. We must continually seek new management methods and organizational structures in order to improve our effectiveness.

Developing Principles of Action

Again, building on our mission statement and using the NGT to develop the philosophies of the organization, Principles of Action were developed by the Executive Board. The themes from the mission statement were expanded into our principles of action, which are:

In our daily work, we

- Recognize that the user of NAVAVNDEPOT products is best able to judge them, so we

-- seek fleet comments and learn to improve our products;

-- join with users of our products in seeking work content to meet their requirements;

-- respond to fleet requests.

- Seek to deliver the most effective products and services, so we

-- are constantly alert for ways to improve our work processes;

-- use time, material, and equipment efficiently;

-- work with suppliers to improve the products they provide;

-- balance short and long term considerations for best total effect.

- Seek to develop our fellow workers' opportunities to find satisfaction and fulfillment at work, so we

-- inform our fellow workers of events and conditions that may affect their work;

-- provide knowledge and resources suitable for each task;

-- solicit recommendations from all levels within the depot;

-- move energetically to eliminate factors that impede quality or productivity.

Key Accomplishments and Goals

From the mission statement, common observations of the business environment and principles of action, Key Accomplishments and Goals were developed by the Executive Board using the NGT. A Key Accomplishment is a forward-looking statement of required actions necessary to achieve the mission. For each Key Accomplishment the Executive Board develops a set of goals (1) against which the Executive Board can measure the efforts expended to reach the goal and incremental milestones on the way to attain the goal, (2) a set of strategies describing how the goals are to be met and a set of short and long-range objectives to focus efforts over the short-range, and (3) provide guiding objectives for mid-level and first-line supervision, staff, and worker direction. The Key Accomplishments and Goals chart the long term course of action while the objectives implement the plan year by year. It is the objectives that specify quality and productivity initiatives, cost reductions, and management improvements. For example, long term financial management initiatives reflect a 20 percent cost reduction goal over five years while the specific cost reduction goals for FYs 87 and 88 are established at $17 million and $26 million, respectively. Attainment of these goals also results in a continual improvement in the depot competitive position as well as improving the effectiveness and efficiencies in use of depot resources. NAVAVNDEPOT Cherry Point Key Accomplishments are:

- TQM is the predominant driving force in the depot.

- The Depot will systematically plan for workload that utilizes the strengths of our human and technical resources in the satisfaction of customer needs.

- The competitive position of the NAVAVNDEPOT will be constantly improved through the use of sound business principles.

- The NAVAVNDEPOT is committed to the improvement of the quality of life of our employees and that of our neighbors.

With each Key Accomplishment, a goal, strategy to meet the goal, and objectives are developed with measurable performance, schedule, and action organization. An example of this is shown below in Figures 1 and 2.

Key Accomplishment III - The competitive position of the NAVAVNDEPOT will be constantly improved through the use of sound business principles.

Current Situation - The competitive position of the depot can be enhanced by the continuous review and improvement of management of the basic ingredients necessary for the support of our product lines.

Goal III.1 - By 1 January 1989, the depot will institutionalize the competitive bid process - Action: Business Office

Goal III.2 - By 30 September 1991, the Executive Board will standardize an internal measurement system for total performance that represents our constancy of purpose - Action: Management Controls Department

Figure 1. Key Accomplishment Broken Down into Goals

Goal III.1 - By 1 January 1989, the depot will institutionalize within the depot the competitive bid process - Action: Business Office

Strategy - Establish an organization responsible for the formalization and integration of the competitive process into routine application. Our position on contracting is to make every effort to win.

Objectives:

1. By 15 August 1987 the Executive Board will finalize the organization of the Business Office - Action: Business Office

2. By 1 October 1987 the Management Controls Department will implement the new pricing strategy that moves costs closer to the product for more accurate product pricing - Action: Management Controls Department

3. By 1 January 1988 the Business Office will identify the initial training requirements - Action: Business Office

4. By 1 March 1988 the Business Office will develop a "boiler plate" competitive bid package - Action: Business Office

Figure 2. Goal Broken Down into Measurable Objectives

Nominal Group Technique (NGT)

A systematic prioritizing process, called the Nominal Group Technique (NGT), was used in each of the data gathering phases. The NGT process calls for each member to list what issues and factors need to be addressed in that phase of the business plan. Each member of the Executive Board is given several minutes to write down five to six ideas, issues, or·factors to be considered. In a round robin fashion, each member is queried for one of the items on his/her list. All ideas are listed by the facilitator for all to see. The facilitator quits querying members only when all ideas are exhausted. The members can add to their list as other members are queried. In this brainstorming session, all ideas are considered. Once the general list is complete, the members look for ideas that are related and/or mutually supportive. With the consensus of the group, listed items are combined. Combinations can occur using two methods: (1) combine like thoughts into one idea or sentence that covers the subject, or (2) pick one overriding subject idea with indentured complementary, supplementing, or sequential thoughts listed under the primary subject. The final phase of the NGT process has each member prioritize his/her top ten priorities. Each member votes secretly on his/her top ten priorities. The facilitator assigns weights to priorities and tallies up the scores for each idea (i.e., 10 points for each #1 priority, 9 points for priority #2......, 1 point for each priority #10). Natural break points can be determined as to where to stop the final listing. This natural break normally occurs at the #5 to #8 position.

The NGT process proved very beneficial in performing the business environmental scan, assessing the principles of action and was especially useful in ascertaining the urgency for the Key Accomplishments. The process provided a

complete list of actions required, produced consensus within top management, and helped develop team building within .the Executive Board that will be required later for implementation. By relating ideas, misconceptions and misinterpretations were clarified and problems among issues resolved. Although the process was structured, the task of dealing with such complex issues was not easy. The task became an intensive effort to deal with a wide variety of issues, summarize information to Key Accomplishments, and apply information to generate goals, strategies, and objectives. The NGT process greatly eases this task by involving group dynamics where no one person is pre-emptive.

Full Implementation and Critical Problems

There remains the step of implementing the business plan in managers' performance evaluations and through the budget process. This step is ongoing as the annual Basic Performance Appraisal System/Performance Management and Recognition System objectives and FY 88/89 budgets are developed.

The business planning technique as illustrated here has two critical problems. The technique tends to emphasize external threats to the organization and secondarily on organizational weaknesses. Capitalizing on opportunities for the organization and strengths of the organization are minimized by the process. Had it not been for the two previous strategic planning sessions, the business plan would not be balanced and the NAVAVNDEPOT would have missed a critical portion of the planning process. The second problem is that of middle and lower-level management involvement. The goals must be further spread by developing Plans of Action and Milestones (POA&Ms) by the manager responsible for the action. In most cases this will also involve personnel from other than the manager's direct organization. Commitment must flow from the Executive Board members to the managers with goals for action to support the team effort required to accomplish the goal.

The business plan was facilitated by an inside facilitator who is not a member of the Executive Board. Much effort initially went into establishing the planning process to generate the business plan. Participants have become familiar with the process and their roles. Subsequent iterations of the plan are expected to be even more fruitful and refined. Many goals take longer than one or two years to attain. The importance for the long term, therefore, lies in embedding the planning process in the organization.

Mission
Statement

Environmental
Scan

Principles of
Action

Key Accomplishments
and Goals/Plans of
Action and Milestones

Basic Performance   Financial Commit-
Appraisal System/   ments/Objectives/

```
        Performance Manage-              Results
        ment and Recognition
        Systems Objectives
```

Figure 3.   Linkage of the Hierarchy of Business Planning Process

TOTAL QUALITY MANAGEMENT (TQM)
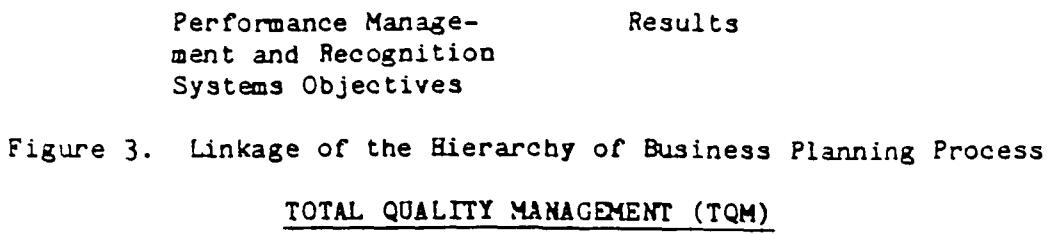
TQM is viewed as a predominant driving force in the NAVAVNDEPOT to enhance the depot's competitive posture. This is evident by being the #1 Key Accomplishment for the depot as a comprehensive approach to management using quantitative methods and involving worker participation to control and continuously improve processes and increase customer satisfaction. The TQM philosophy of management was initiated some three years ago at the depot and has proven to be a dynamic method for problem detection and process improvement.

The original case study went into the advantages of the TQM process, presented the step by step plan for implementation of TQM and training of trainers at NAVAVNDEPOT Cherry Point, and gave several examples of the use of the TQM process. The examples used were the secretarial Employee Participation Group (EPG) highly successful efforts to improve the quality of outgoing naval messages, H-46 aft transmission reliability improvements, H-46 cabin floorboard productivity improvements, and T62 gas turbine compressor process improvements.

TQM Problem-solving Organization and Training

The TQM efforts have been intensified and more highly structured to accommodate this intensified effort. The interlocking Quality Management Boards (QMBs) and Process Action Teams (PATs) have been retained. The QMB/PAT management structure is as shown in Figure 4. The TQM problem-solving organization and responsibilities of each functional element are defined below:

    -   Executive Steering Committee (ESC) - Committee composed of top management representatives which set the policies to be followed and set the policy in implementing TQM. It provides the ultimate level of support for QMBs and PATs.

    -   Key Implementation Training (KIT) - This group consists of people who will facilitate TQM implementation. It will perform the following functions: process control coordination, training development, organization development, documentation and measurement, and facilitator coordination.

    -   Quality Management Boards (QMBs) - These boards are comprised of members from relevant areas, i.e., department, division, etc. They provide the organizational structure that will eliminate friction between various organizational units and enable the use of group problem-solving techniques. QMBs are permanent groups; they will not dissolve after problems are solved, but will oversee continual process improvement.

    -   Process Action Team (PAT) - The shop-level QMB team is comprised of individuals working on a specific issue, problem, or process. The teams are specifically formed to address a particular concern and will dissolve on completion of their work.

- Facilitators - Consists of in-house personnel selected and trained to serve as trainers and consultants to the various QMBs and PATs.

- TQM Coordinator - This individual will monitor, plan, and collect information about progress and assist with administrative arrangements or whatever else may be needed to ensure implementation activities continue. This individual is responsible for implementation of policy and operational administration initiatives pertaining to the overall TQM effort, including directing KIT efforts. As implementation expands to the entire organization, this person will become more crucial.

TQM ORGANIZATIONAL COMMUNICATION FLOW
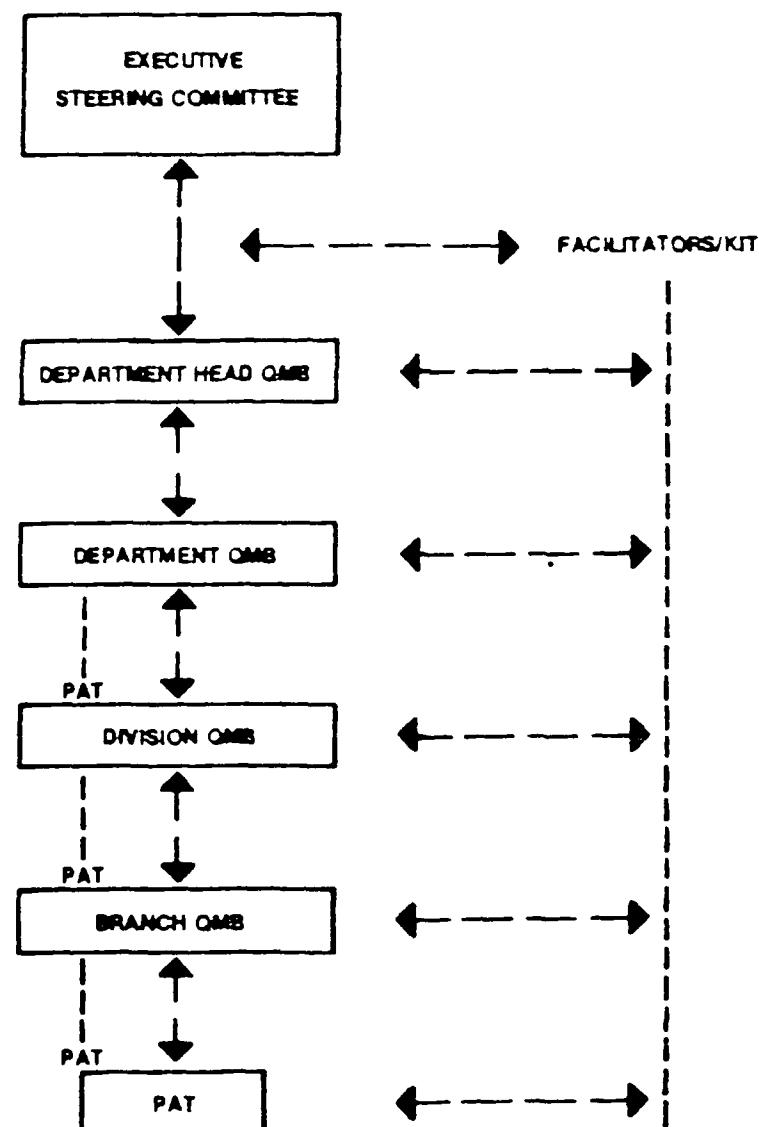
Figure 4. TQM Organizational Communication Flow

A full-time TQM coordinator has been established. The KIT has been filled with depot personnel on collateral duty. Approximately 1,400 depot employees (out of 3200) have completed indoctrination training in TQM. This training is ongoing and should include all employees by the end of the year. The TQM training, besides including orientation into the benefits of statistical process control and Deming's principles, also includes labor transaction (clocking) training. Proper clocking is emphasized because of the feedback information provided for developing budgets, workload standards, and other product and cost measures. TQM training has been provided to all depot managers and supervisors. This training, provided in varying degrees, includes:

- Introduction to Quality Management (Locally developed 8 hour course)

- Methods for Management of Productivity and Quality (Deming 32 hour course from George Washington University)

- Guidelines for Implementing a Quality Improvement System Workshop I and II [Naval Personnel Research and Development Center (NPRDC) 32 hour course]

- Structured Problem-solving and the Basic Graphic Methods (NPRDC 40 hour course)

- Total Quality Management Training for Supervisors and Managers (Locally developed 4 hour course)

- TQM Training for Supervisors and Managers (Deming 4 hour course provided by Satellite)

The above courses, as well as a course in group dynamics, have also been provided to all TQM facilitators. All quality assurance personnel have taken Creative Management Practices instructed by Deming on videotape. A special 4 hour Structured Problem-solving and Basic Graphic Methods Training Course is being developed for QMBs. Development and initial presentation is complete. After initial presentation, this course will be presented to new boards as they are formed.

A TQM "how to" manual has been developed and published to aid QMBs, PATs, and facilitators with their responsibilities. This manual:

- Describes the organization,

- Details the duties and responsibilities of each functional element within the organization, and

- Standardizes the implementation of TQM.

A simple model that can generally be exported from shop to shop has been developed and put into use. This model utilizes a data collection sheet (attribute data), Pareto analysis, cause and effect analysis, and attribute control charts.

A Statistical Process Control (SPC) Implementation Strategy has been developed and approved as a work project that should assure some form of SPC in all

applicable production shops within a year. This project is currently implemented in ten production shops.

The NAVAVNDEPOT currently has 17 active QMBs. PATs are regularly formed and dissolved as problems are identified and the process brought under control. The QMB organization is continuing to expand with new QMBs being formed regularly.

TQM Case Studies

Many of the gains experienced when TQM is applied are solutions that appear to be intuitively obvious once the problems are identified. One simple problem involved the QF-4N (F-4 aircraft in a drone configuration) engine control panels and throttle panels. These panels were sent to the back shops for metal modification and rubber installation. The modification and installation were being improperly done in accordance with standard F-4 panel blueprints. The specifications for the QF-4N engine control panels and throttle panels were added to the applicable prints and provided to the back shops, resulting in less reprocessing and a 63 percent productivity improvement. In another case, the T400 engine (used on the AH-1J/T and UH-1N helicopters) combustion exit ducts were being cleaned using glass bead blasting, resulting in a glass bead residue between the inner and outer liners of the ducts. A block-off plate was designed and manufactured to prevent the entrapment of the residue, resulting in a 60 percent productivity improvement. In a third case, bearing rod end threads on the T58 engine (for the H-46, H-2, and H-3 helicopters) were routed to the machine shop for inspection and rework, if required. It was discovered that only a small percentage needed rework and inspection could be accomplished in the bearing shop during routine rework with only those needing thread rework routed to the machine shop. This resulted in a 60 percent improvement in productivity. In a fourth case, every even-numbered aircraft rod assembly on H-46 aircraft were being sent for 100 percent inspection to check for defects. This inspection revealed few defects, thus statistical quality control inspection rates were imposed based on MIL-STD-105D (percent defective), improving productivity by 90 percent and providing adequate inspections.

Several productivity improvements involved developing and implementing repair schemes. The retaining lips on the J79 engine (used in the F-4 Phantom aircraft) compressor rear casing became worn and corroded beyond usable limits, resulting in the casing being scrapped at a cost of $11,383 per unit. A repair to weld the damaged area was implemented, costing $305 per unit, and the casings are being returned to service. A T76 engine (used in the OV-10 Bronco) engine combustion chamber exhibited cracks which exceeded the limits of the overhaul instructions. The location of the cracks was evaluated and it was determined that the location was not in a critical area. A weld repair was developed that would not adversely affect safety or serviceability, thus weld repair costing $16, vice $6940 cost for scrapping the combustion chamber, was instituted. The T58 engine turbine front air seals were being rejected and scrapped because of excessive wear of the seal teeth. It was determined that the seals could be repaired by using a dabber weld to rebuild the teeth at a cost of $134 vice the cost of the seal for $553. In a fourth case, the OV-10 starter generator mounting adapters were being scrapped for cracks found in the cage area. Weld repairs were instituted at a labor cost of $21 per unit vice $730 per unit for replacement.

In order to detect and repair all the cracks in the rotor hub, the hub was being reworked in the machine rework shop from one to three times and each time was sent to the nondestructive inspection shop for nondestructive inspection. This required excessive man-hours and greatly increased turnaround time (TAT). After investigation by the Metals Branch OMB, it was determined that if all the cracks were detected early in the rework cycle of the hub, many man-hours could be saved and TAT could be decreased. A contour probe light is being used in the machine rework shop to detect cracks in the hub. All droop and flap stops are checked to determine if another grinding operation is necessary before removing the hub from the machine. Eighty percent of the cracks are being found before the hub is sent for final NDI. This new practice saves transportation, machine setup time, and had deleted repetitive NDI operations. It has eliminated at least 2.24 man-hours per unit, has reduced TAT by two days per unit, and reduced labor cost from $131 to $93 per unit.

Various jobs were performed in the Comptroller Division utilizing manual operations in working with the automated financial management system, the Naval Air Industrial Financial Management System (NIFMS):

-   Detail Variance Ledger/Extract NIFMS Billing Data
-   Extract NIFMS Direct Cost Data
-   Travel Requests/Accruals Report
-   NIFMS Report Handling
-   Rates Development Procedures
-   Production Performance Report
-   Extract NIFMS Budget Data
-   Extract NIFMS Indirect Cost Data

The Financial Management PAT reviewed Comptroller Division internal manual procedures and recommended full automation of the first four operations and partial automation of Rates Development Procedures. The last three were determined not to be economically automatable, unless they were automated for all six NAVAVNDEPOTs. The Travel Requests/Accruals Report and NIFMS Report Handling have been automated. Requests have been generated for the programming of the other three functions which were recommended for automation.

Labor Savings (based on present worth, interest set at 10 percent) at NAVAVNDEPOT Cherry Point only are:

-   Extracting NIFMS billing Data and Detail Variance
    Ledger Preparation $10,344

-   Extracting NIFMS Direct Cost Data and Loading into
    Personal Computers $ 3,550

-   Travel Requests/Accruals Reporting and Control $ 2,017

-   Rates Development Procedures (partially automated) $ 6,734

ADP Savings (charge-back on Regional Automated Services Center Contract):

-   NIFMS Report Handling $22,194

Less: One time cost of automation

- Extracting NIFMS Billing Data and Detail Variance Ledger Preparation	$ 765
- Extracting NIFMS Direct Cost Data and Loading into Personal Computers	$ 1,530
- Travel Requests/Accruals Reporting and Control	$ 77
- Rates Development Procedures	$ 2,296
- NIFMS Report Handling	-0-

This results in an overall productivity improvement in the Comptroller Division of 2 percent and a .6 percent charge-back savings on the $3.7 million per year contract with the Regional Automated Services Center for complete time.

There are many other examples of problems uncovered, underlying causes identified, solutions proposed and implemented, and the application of statistical quality control techniques to track and measure quality and productivity improvements; unfortunately, space does not permit describing each and every case study.

MEASUREMENT OF QUALITY AND PRODUCTIVITY IMPROVEMENT

A total quality management implementation matrix is the basis for measuring progress. This matrix is made up of the cost of products produced (aircraft, engines, ground support equipment, and components); scheduled versus actual completions, and the number of Quality Deficiency Reports/Aircraft Deficiency Reports (QDRs/ADRs) received from customers. This data is readily available from the present Manufacturing Resource Planning (MRP-II) system as described in detail in the original case study. A local area network and distributed computing capability has been added to make' the MRP-II data more readily available as well as development and analysis of trends more automated.

The analysis of cost of products produced helps to pinpoint areas where corrective action can have the greatest benefit (Paredo's law). Before this analysis can be complete, however, the "most nearly actual" cost to produce the product must be known. This cost must include direct labor, direct material, production indirect, and overhead. A description of the cost/management accounting system developed to give these costs can be found in an article entitled, "Managing By Actual Costs, in the 1987 International Industrial Engineering Symposium/World Productivity Forum Proceedings. Cost data is readily available from the financial management system; this data must be provided in a timely, readily understood manner to be useful in detecting trends as soon as an out-of-control situation is detected. Through TQM, the NAVAVNDEPOT management and workforce intends to push for continuous cost improvements through process improvements that allow better utilization of material, equipment, and facilities. This is done by working smarter and harder.

Gainsharing

Productivity gainsharing is an employee involvement system designed to motivate

employees to improve the productivity of their work group through better use of labor, material, etc. In addition, gainsharing provides a means of measuring specific areas of productivity and offers a mutual stake in the sharing of any increase to total organizational productivity with all those responsible for the increases. The Productivity Gainsharing Program is intended to encourage greater productivity through physical effort (working harder) and through process improvement (working smarter). It is anticipated most significant gains will be made in process improvement utilizing the TQM organization. A NAVAVNDEPOT Cherry Point Productivity Gainsharing plan has been written with the intent of providing an appropriate award system/payout mechanism for these TQM efforts. The gainsharing plan was developed by the Productivity Gainsharing Committee, chaired by the Productivity Gainsharing Coordinator (Production Department Head), representatives from appropriate departments, and labor union officials.

The plan is a SHRED COST model with baseline data developed based on the average NAVAVNDEPOT cost performance for each product for each of the previous quarters. Productivity gains are paid for each quarter that the facility exceeds this average. The baseline is also updated each quarter with new quarterly data. Productivity Gainsharing awards are paid upon increased productivity (i.e., decreased auditable costs). Payout is also based on meeting acceptable quality levels, defined as maintaining statistical process control of the quality index, and acceptable schedule production using a schedule index. An equal sharing (50 percent/50 percent) of savings between the activity and employees is based upon productivity increases in the baseline.

A more complete description of Productivity Gainsharing with TQM is planned at the 1988 International Industrial Engineering Symposium.

CONCLUSION

Once a total quality and productivity improvement program is implemented through a 3 phase approach - strategic planning, TQM, and measurement of improvement - the efforts have just begun. While strategic/business planning occurs on an annual basis, with continual updates, TQM and measurement must occur on a continuing basis with intensity increased until 100 percent of the organization is involved and committed to continuous quality and productivity improvement. As described in the original case study, NAVAVNDEPOT Cherry Point was only 10 percent involved in TQM. This update represents about 20 percent depot involvement. It is expected that Productivity Gainsharing should help accelerate this pace. No firm that I know of in the U.S. has reached the 100 percent emersion, and only a very few Japanese firms are close. Continuous management of all 3 phases is necessary if continued improvements are to be maintained.

BIOGRAPHY

Mr. John S. W. Fargher, Jr. began his career at the Intern Training Center, Red River Army Depot as a Production Design Engineer. He has held positions as systems engineer for the Small Caliber Ammunition Modernization Program (SCAMP), Frankford Arsenal; Chief of the Production Planning and Control, Hawthorne, NV; Lead Engineer at Rodman Laboratory, Rock Island, IL; Chief Industrial Engineer with the Iranian Aircraft Project Manager's Field Office in

Teheran, Iran; Deputy Chief of the Materiel Systems Development Division, U.S. Army Transportation School; Professor of Acquisition/Program Management at the Defense Systems Management College; Deputy Project Manager for the Light Armored Vehicle Directorate, Quantico, VA; and Head of the Production Planning and Control Department, Naval Air Rework Facility, Cherry Point, NC. He just completed temporary assignments as Technical Director of the Depot Operations Directorate and acting Executive Director at the Naval Aviation Logistics Center. He is currently the Management Controls Department Head and Comptroller and Business Office Head at the Naval Aviation Depot, Cherry Point, North Carolina.

Mr. Fargher holds a B.S. in Engineering Science from Montana College of Mineral Science and Technology; Master of Engineering in Industrial Engineering from Texas A&M University, and an M.S. in Systems Management from the University of Southern California. He is a graduate of the Program Management Course at DSMC and the Program for Senior Officials in National Security at Harvard University. He is a member of Alpha Pi Mu and Tau Beta Pi and has authored many articles and several books on program management, integrated logistics support, mathematical modeling, production planning and control system automation, and quality and productivity measurement. He is a senior member in IIE.

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Improving Combat Capability Through R&M 2000 Variability Reduction

Capt. Bruce Johnson
HQ USAF/LE-RD
January 1989

IMPROVING COMBAT CAPABILITY THROUGH
R&M 2000 VARIABILITY REDUCTION

HQ USAF/LE-RD, January 1989

THE PROCESS

Improving combat capability is a major Air Force objective. This is becoming increasingly difficult in the face of constrained manpower and fiscal resources. However, there is a solution. Substantial increases in combat capability are achievable through more reliable and maintainable weapon systems. Such systems are able to complete more missions with less spares, support equipment, facilities and maintenance personnel.

Weapon systems fail for many reasons. Some components, like tires, wear out. But most systems fail because of poor design, the use of defective parts and materials, or poor workmanship. The cause of these failures is *variability* in the design and manufacturing processes. The problem variability presents is that it exists in nearly all processes and it results in marginal or non-conforming products. The variability comes from the fact that conditions under which these items are produced change. Variability reflects the differences in raw material, machines, their operators and the manufacturing conditions. When process variation increases, the product's physical properties or functional performance can degrade, and the number of product defects increases. The significance variation has on a product's reliability and quality depends on the criticality of the manufacturing process and part characteristics.

There are two ways to reduce variability. Traditionally, the approach has been to tighten design tolerances and increase inspections. Costs climb as scrap and rework increase, and productivity drops. Inspections and tighter tolerances only treat the symptoms and do not resolve the actual problem.

The preferred method is to reduce the variability by improving the process. This can be done by eliminating the causes of variation through statistical techniques, and by developing more robust products which are insensitive to the causes of variation. The methods of reducing variability is aptly named the Variability Reduction Process (VRP).

VRP is a proven set of practices and technologies which yield more reliable and nearly defect-free products at lower cost. It is a structured, disciplined design and manufacturing approach aimed at meeting customer expectations and improving the development and manufacturing process while minimizing acquisition time and cost (Figure 1).
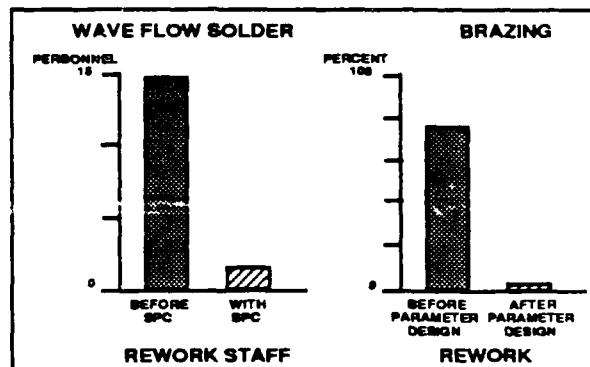
Figure 1. Process Improvements from VRP.

The objectives of VRP are to design robust products which are insensitive to the causes of failure; to achieve capable manufacturing processes that produce nearly defect-free products; and to adopt the managerial attitude of continuously improving all processes. The basic tools are teamwork, statistical process control (SPC), loss function, design of experiment (DOE), parameter design and quality function deployment (QFD). VRP must span all of engineering, manufacturing and management, and include the suppliers (Figure 2).

Figure 2. The Elements of VRP.

CAPABLE MANUFACTURING PROCESSES

Capable manufacturing processes can only be achieved when the critical parameters are known, and the causes of variation are eliminated or minimized. For most processes, SPC is highly effective (Figure 3). It allows the operator to observe the process and distinguish between patterns of random and abnormal variation. It assists the operator in making timely decisions such as adjusting or shutting down the process before defects are produced. When combined with other statistical tools and problem solving techniques (Figure 4), the worker can isolate and remove the causes of abnormal variations.

When the abnormal variations are removed from the process, the process is said to be under statistical control. In many processes, this will not be sufficient. The random variations alone can result in defective products, and their causes should be identified and removed until the process is capable of producing near defect-free products. However, causes of random variation are more difficult to identify, are usually systemic and normally require management action to remove.
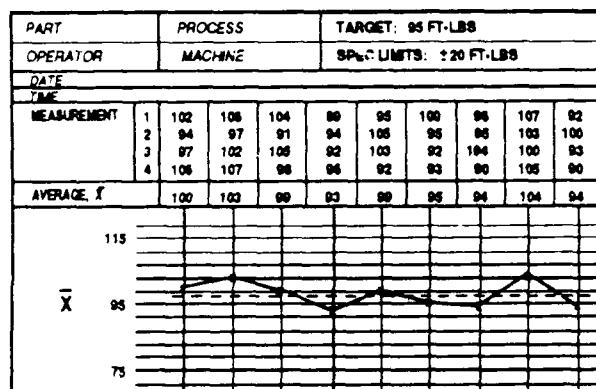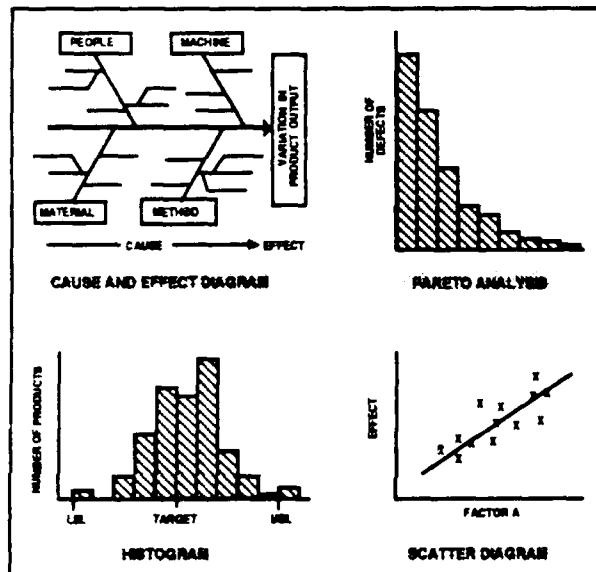
The difference between VRP and traditional methods of quality control is that improvements in quality are achieved through improvements in the manufacturing processes. No longer is better quality to be achieved through tightening specifications and more inspections. In the case of SPC, the manufacturing processes are improved by eliminating the causes of variability. Usually, the process can be centered around the design target and variation reduced well within the specifications (Figure 5).

When implemented correctly, the results can be impressive. For Parlex Nevada Inc, a circuit card manufacturer, SPC was used to cut scrap cost by 90 percent in one year, and changed the company's losses into profits. Boeing used SPC to resolve a rivet flushness problem on the nose section of the 737 aircraft. The improvements saved a half-million dollars a year.

A more powerful method of resolving difficult or complex industrial problems is the statistical design of experiments (DOE). DOE methods have been around for 60 years and have been extensively used by the agricultural, pharmaceutical and chemical industries to advance their products. These techniques can greatly accelerate the rate of improving product designs and manufacturing processes. Such statistical experiments will aid the engineer in identifying the critical parameters for SPC, isolating the causes of variation, and improving the product's technical or operational characteristics.

DOE works by measuring the effects that different inputs have on a process. This is done by identifying a prospective set of input factors, varying

Figure 3. SPC Control Chart

Figure 4. Tools Workers Can Use to Identify
the Causes of Variation.
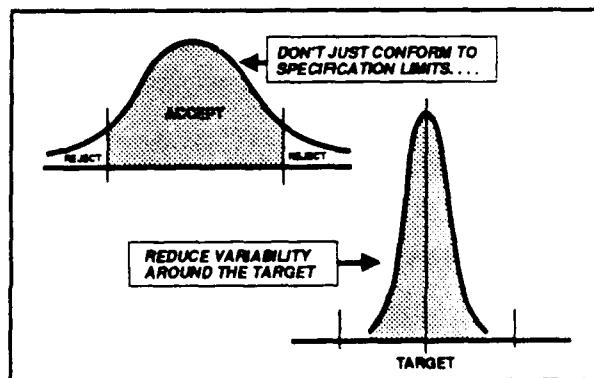
Figure 5. Design and Build to Target Values,
Not Specification Limits.

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the inputs over a series of experiments, collecting the data and analyzing the results. An input may be varied over a range of values such as can be done with an oven's curing temperature or conditionally, such as the decision to add or withhold a curing additive. The methods, whether they employ a full-factor, fractional-factor, orthogonal array or surface response technique, use a statistical approach that ensures accuracy and validity.

Well-planned experiments can have dramatic results. For example, a government-owned-company-operated (GOCO) munitions plant had a serious problem in producing the ADAM mine. Although SPC was in use and 12 of 13 processes were within their tolerances, 19 out of 25 lots were rejected. Aerojet Ordinance, the plant operator, decided to apply a Taguchi experiment to identify the critical parameters. They selected the 13 parameters used in the SPC program and tested parameters at three different levels. Only 27 experiments were conducted, firing 6 rounds each. The results were profound. Four parameters were found to be critical, and when set at their best levels, the process produced good lots without any rejects. The other nine parameters were less important and their tolerances can be relaxed. Results: production schedule met while achieving significant cost savings.

ROBUST DESIGNS

Having a capable manufacturing process is not enough. It may not be economical to remove or control some of the causes of variation. Therefore, it is necessary to develop robust manufacturing processes which are insensitive to the manufacturing conditions, materials, machines and operators. In most cases, *the greatest improvements come from robust designs.* These improvements are achieved through parameter design, a technique of selecting the optimum conditions (i.e. determining the ideal parameter settings) that minimize the variability without removing the causes of variation.

During parameter design, a set of parameters is identified to enhance the product, and a series of experiments is conducted to observe the effects of the parameters on the desired part characteristics. The results

could identify new parameter settings that improve the product and increase yield. For example, the problem an engineer may want to solve is the variability of ceramic parts. The source of variation is the uneven temperatures in the kiln. Because modifying the kiln is too expensive, the engineer conducts several experiments to identify a way to minimize the effects of the uneven temperature. For the experiment, he selects as parameters the amounts of the ingredients, their textures, blending procedures and firing temperatures. For validity, the engineer should use DOE procedures for conducting the experiment. An orthogonal array may be used to minimize experimental time and cost. The results will enable the engineer to fine new parameter settings that minimize the effects of uneven firing temperatures.

The problem with most design approaches is that parameter design is rarely done. Most engineers focus on the system design to develop the product, and immediately transition to tolerance design to establish the specification limits Often, the results is a inferior product which is sensitive to variations in the manufacturing process. Parameter design should be done before tolerance design.

Parameter design can also be used to design and produce a more robust product that will perform better over a wider range of operating conditions and environments. It can be used to enhance a desired customer's need such as a smooth automobile ride, or to enhance an engineering requirement such as to lower the susceptibility of corrosion.

The success of parameter design and SPC hinge on the engineers' understanding of the customers' needs. Quality Function Deployment (QFD)
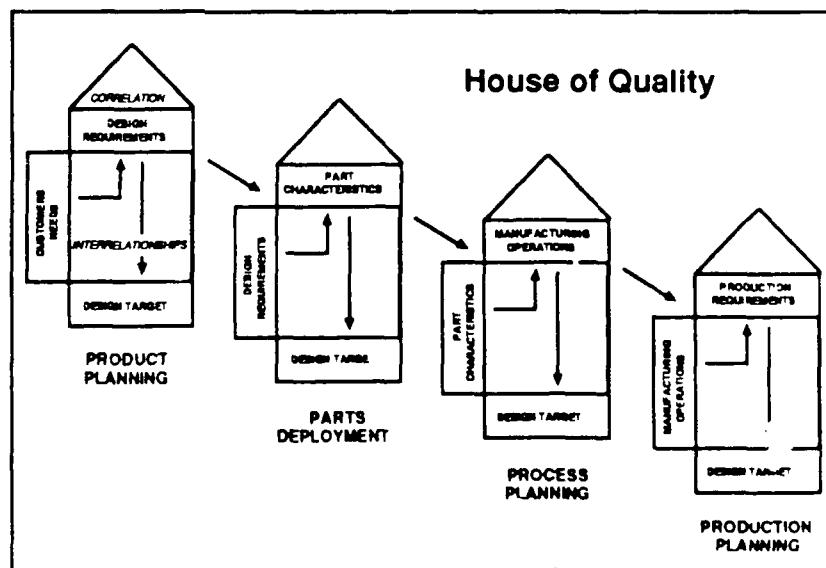
Figure 6. *Quality Function Deployment.*

is a systematic approach for developing and translating the customers' needs into the critical part characteristics and production requirements. The QFD requirements matrices are designed to minimize the chance of starting the design process with incomplete or erroneous requirements. They provide a methodology which assures an orderly translation of the customers' requirements throughout the product development process (Figure 6).

The basic approach used in QFD is conceptually similar to the practice employed by most companies. The difference lies in its structure. It compels the different disciplines and departments to communicate. QFD starts by defining the customers' requirements in the customers' terminology and translates these requirements into engineering requirements. These engineering requirements become the product characteristics which should be measurable and given target values. If properly executed, the product should fulfill the expectations of the customer.

The other matrices translate the engineering requirements into part characteristics, required manufacturing operations, and production requirements. Each matrix identifies the design targets, interrelationships and priorities. The end result should be a set of operating procedures which the factory can follow to consistently produce the critical part characteristics.

The design environment best suited to produce robust products is concurrent engineering (also referred to as simultaneous engineering). Concurrent engineering addresses all the customer, design and manufacturing issues up-front starting with concept exploration. The process employs good design practices, interdisciplinary teams and a structured requirements process, such as QFD, to concurrently develop the product and manufacturing processes. Its practice encourages communication between the design, product and production engineers. Concurrent engineering replaces the typical "sequential" approach to product design, which is more costly and time consuming. The effects concurrent engineering can have may be summed up by the following example. Using sequential engineering practices, the Allison Transmission Division estimated in 1982 it would cost $100 million in capital investment and $75,000 per unit to replace the transmission in the M-113 Armored Personnel Carrier. In 1987, using concurrent engineering, Allison's estimate dropped to $20 million for capital investment and $50,000 per unit (Figure 7).

CONTINUOUS IMPROVEMENT

For VRP to succeed, management from the top down must adopt new attitudes about reliability and quality, and must become *directly involved* in continuously improving the design and manufacturing processes. They must implement programs to foster improvement, teardown the barriers that inhibit change, instill teamwork, establish goals for improvement, and provide education and training for successful implementation.

Management's primary objective should be to satisfy the customer and serve the customer's needs if a company is to stay in business and make a profit. Reliability and quality must come first — not profit. *If done smartly, reliability and quality will reduce cost and increase profit.* For example, Hewlett-Packard's Yokogawa plant implemented many of the VRP techniques and, after eight years, they achieved 240 percent increase in profit, 120 percent increase in productivity, 19 percent increase in market share, 79 percent decrease in failure rate, and 42 percent decrease in manufacturing costs.

Management must become *process-oriented* and stimulate efforts to improve the way employees do the job. Teamwork is the foundation for continuous improvement. An important part of team building is the assignment of people to multi-functional management teams, interdisciplinary design teams and process improvement teams. Everyone should be involved in process improvement.

Management should implement programs to foster continuous improvement, use education to change attitudes and provide training. Change will be gradual and will require a long-term outlook. In Japan, most of the small improvements come from the workers' suggestion system called *Kaizen Teian*. Kawasaki Heavy Industries Aircraft Works has one of the more impressive programs. In 1987, each employee submitted an average of 229 suggestions
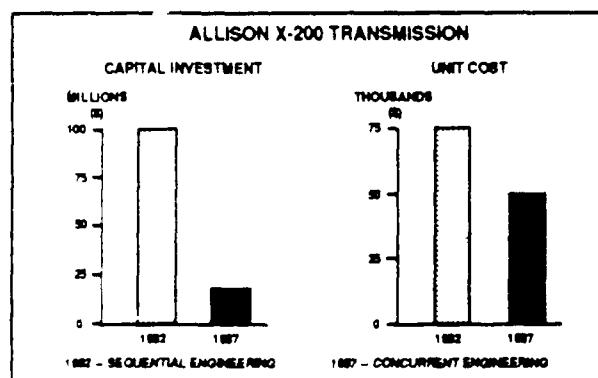
Figure 7. Concurrent Engineering.

and 92 percent were adopted. Savings were estimated at $35 million. At a Texas Instruments plant, they introduced an enhancement program, and over the past five years, the program has reduced defects by 2,300 percent (Figure 8).

Management must take responsibility for process improvement while giving the workers the responsibility of maintaining the process. Without the ability to maintain the existing process, there can be no improvement. This means management must give the worker ownership of his processes and allow the worker to improve or stop the process as necessary. In many progressive companies, workers are involved in the development of their own operating procedures, and in some cases, they write their procedures.

Management must change the accounting procedures. The notion that loss only occurs when the product is outside the specification limits is obsolete. Loss includes not only the cost of scrap and rework, but also the cost of warranties, excess inventory and capital investment, customer dissatisfaction, and eventual loss of market share. The traditional go/no-go approach to quality should be replaced with a powerful monetary loss function to better account for loss (Figure 9). A quadratic loss function allows management to better assess the true cost of production processes and the benefits derived from process improvements (Figure 10). Most important, the loss function supports continu-
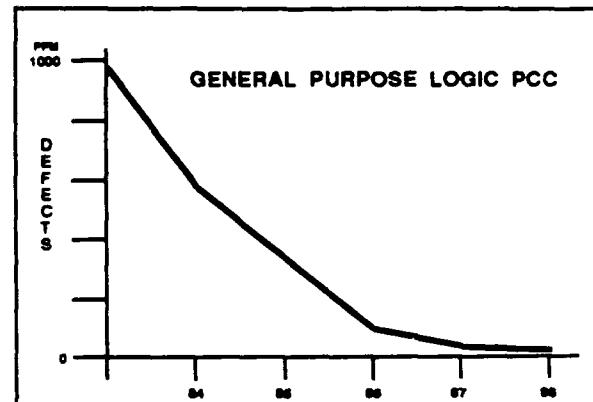
Figure 8. Continuous Improvement.
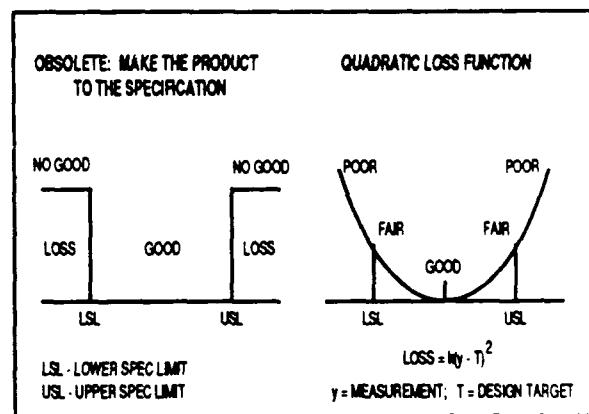
Figure 9. Quality Loss Functions.

	A	B	C	
PROCESS CAPABILITY INDEX (Cp)	PROCESS SPREAD RATIO $\frac{P}{S}$	AVERAGE $ LOSS/UNIT /DOLLAR (COLUMN A)' $	AVERAGE $ LOSS/UNIT COLUMN B x Ao	AVERAGE $ LOSS FOR RUN COLUMN C x N
1.00	1.0	.111	$22.20	$22,200
1.11	0.9	.090		
1.25	0.8	.071		
1.43	0.7	.054	$10.80	$10,800
1.67	0.6	.040		
2.00	0.5	.028		
2.50	0.4	.018		
3.33	0.3	.010		
5.00	0.2	.004		
10.00	0.1	.001		

COST AVOIDANCE: $11,400

ASSUMPTIONS
- (±) TOLERANCE EQUAL
- PROCESS IS CENTERED
- PROCESS IS SYMMETRICAL
- QUADRATIC LOSS FUNCTION
- "RATIONALLY" SET SPECIFICATIONS

EXAMPLE SHOWN
- ESTIMATE SAVINGS OF IMPROVING PROCESS FROM 1.0 TO 0.7
- DOLLAR LOSS AT EITHER SPEC LIMIT IS Ao = $200
- NUMBER OF UNITS TO BE PRODUCED IS N = 1000

Figure 10. Table for Evaluating the Benefits from Process Improvement.

5

ous process improvement because minimizing the loss equates to reducing the variability around the target.

IMPLEMENTATION

The adoption of VRP begins with the conviction that change is necessary and beneficial. Implementation is an evolutionary process. VRP may start out in a single product line at one factory with a single group of suppliers. But it must be grown with the long-range goal that it will encompass the entire enterprise. The Air Force strategy for VRP is to encourage defense contractors and suppliers to (1) foster top-level commitment to VRP, (2) involve all levels, departments and vendors, (3) apply the VRP in a systematic approach, and (4) create a culture of continuous process improvement. Within the Air Force, the Vice Chief of Staff has directed all commands involved in weapon system acquisition and support to implement VRP by 1993. The Air Force acquisition regulations have been rewritten to incorporate VRP in the acquisition process. VRP will be an essential part of Air Force's Total Quality Management program (Figure 11).

Figure 11. TQM / VRP Relationhhip

SUMMARY

The Variability Reduction Process makes two seemingly contradictory goals compatible: to produce highly reliable and maintainable weapon systems while reducing development time and costs. The method is to design robust systems, produce them with capable manufacturing processes, and achieve continuous improvement.

VRP provides a win-win situation. The Air Force obtains more combat capability with the available dollars. Industry is able to satisfy their customers, improve productivity and lower costs.

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4-4

Implementation of Total Quality Management at Pearl Harbor Naval Shipyard

Gerry A. Damon

Implementation of Total Quality Management at Pearl Harbor Naval Shipyard

Gerry A. Damon[1]

This paper discusses the strategy and methods used at Pearl Harbor Naval Shipyard to apply Dr. W. E. Deming's 14 management principles to the complex world of ship overhaul and repair. The purpose of Total Quality Management is to improve quality, and thereby reduce costs, and increase productivity, thus improving Pearl Harbor's competitive position in the market. A brief, general history of process control is given as well as a close examination of the current management and overall conditions at Pearl Harbor. The interdependent roles of top management, middle management, the union, and consultants are evaluated, and areas for improvement are examined.

Introduction

PEARL HARBOR Naval Shipyard is one of eight public shipyards engaged in the overhaul and repair of conventional and nuclear-powered surface ships and submarines of the U.S. Navy. These ships, from their power plants to their sophisticated weapons systems, are consistently on the leading edge of technology. Work performed on these ships during an overhaul, maintenance, or repair cycle requires personnel in the labor force whose skills encompass a variety of vocations—engineers, machinists, accountants, welders, computer specialists, pipefitters, riggers, crane operators, and personnel specialists are but a few of the skilled personnel required. Of prime importance in ensuring success in the business is a management structure and philosophy dedicated to continuous improvement in quality, productivity and cost reduction.

Recognizing that increased productivity and reduced costs are end products of quality improvement, Pearl Harbor, in April 1986, elected to adopt Dr. W. E. Deming's management fundamentals. The purpose of this presentation, therefore, is to discuss the strategy and methodology which is being used to apply Dr. Deming's principles to the complex world of ship overhaul and repair.

Goal

The goal at Pearl Harbor Naval Shipyard is to reduce costs in order to remain competitive. To achieve this goal, the shipyard has adopted the strategy directed toward "process improvement." This process management approach is based on the philosophy of Dr. W. Edwards Deming and Dr. J. M. Juran. Dr. Deming states his aim is the transformation of the American style of management. He does not tell how to make this transfo nation, but he provides 14 management principles as a guide. It is top management's reponsibility to infuse these principles functionally and operationally into the shipyard organization and to provide a plan for their implementation. A brief description of these principles is given below:

1. Constancy of purpose.
2. Refusal to accept mistakes/defects.
3. Cease dependence on mass inspection.

4. Buy on quality, not price.
5. Constantly improve production/service.
6. Training for all employees.
7. Leadership.
8. Communication, drive out fear.
9. Remove barriers between departments.
10. Goals, posters, quotas, slogans.
11. Eliminate work standards/management by quotas.
12. Workers' right to pride of workmanship.
13. Education and self-improvement.
14. Top management's commitment.

Pearl Harbor is currently in the process of internalizing and institutionalizing the Deming principles. This means shipyard managers must embrace these principles and apply them in the management of shipyard activities. Management words and actions must reflect and be consistent with these principles. Shipyard policies, procedures, instructions, and daily operations must also be consistent with this philosophy.

Recognizing that past practice and management styles cannot be changed overnight, Pearl Harbor accepted the fact that *this change* in management attitude and behavior will take three to five years. The change process begins by generating awareness through training in the basics of the Deming Principles, problem-solving techniques and statistical methods. The manager then has the opportunity to practice and apply these new ideas and techniques in his/her own environment. The restructured environment is established as part of the change process by the Shipyard Commander and the Steering Committee which has been formed to perpetuate on-going process improvement. The new structure encourages managers to spend a minimum of 10 percent of their time working on the problems of tomorrow. As managers participate in and become more comfortable and adept with these new methods, they see the results not only of their efforts, but also of the entire shipyard's efforts to effect continuous improvement. As the goal to constantly improve becomes a way of life at Pearl Harbor, the result will be a reduction in overhaul and repair costs and significant improvement in Pearl Harbor's competitive position and its ability to provide jobs and job security to a dedicated workforce.

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Management's responsibility

Deming points out that 85 percent of all problems in an

organization are system problems and therefore the responsibility of management. Moreover, the systems and processes that an organization uses are created and established by management. Therefore, managers must understand how to analyze systems processes in order to create a structure that allows all levels of the workforce to be involved in process improvement and control.

It is critical for the top management team to be a role model in the execution of its responsibilities in the transformation process. The team must change its fundamental ideas about how to manage shipyard work and about management's role with personnel. Top management cannot delegate this responsibility; they must actively work to resolve all types of shipyard problems.

Management must learn to think analytically through the process of quantifying and measuring problems. Deming's approach emphasizes making decisions based on facts. Data must be collected, analyzed, and used to identify and solve problems. Statistical process control (SPC) and other quantitative methods provide the tools necessary to collect and interpret data. Training must be provided to develop management understanding in the use of these tools and techniques. Even more important is the use of these tools on real problems. Guidance must be provided.

Job shop business

Many examples of the application of the Deming Philosophy come from industries where mass production and its associated repetitive processes play an important role. Examples may show a production line capable of producing 500 cars per day. Generally, most examples illustrate the repetitive nature of processes. In comparison, the ship overhaul and repair business on sophisticated Navy ships differs greatly. It may take six months to several years to overhaul a ship. Shipyards are in the *Job Shop* business. Some jobs occur only once a year, while new Ship Alterations require entirely new techniques and approaches. The job shop business requires a significant amount of planning up front to order materials, develop software, sequence work, and coordinate the trades involved. Actual work is complicated by limited space access onboard ship. But even with these differences, ship repair effectiveness can be markedly improved through process improvement, that is, looking for ways to streamline processes.

Although much of ship overhaul and repair business is job shop in nature, there are many processes utilized repeatedly. For example, welding, machining, pipe fitting, painting, valve repairs, and software development are all processes that can be improved by reducing variability that occurs today. By understanding what causes variation in our processes and by observing, analyzing, and controlling variability, we can improve our quality and reduce our costs.

Need

The need to improve the way Pearl Harbor manages and conducts overhaul and repair work is directly influenced by the interrelationship of the following factors:

1. High cost: Cost of overhauls and repairs have been spiraling upwards.

2. Reduced budget: The Navy's share of a reduced federal budget must be stretched over an expanded fleet.

3. Competition: The public shipyards have begun competing with the private sector for Navy work. Pearl Harbor expects to competitively bid on future overhaul work packages

4. Need for improvement. There is a great need for improvement at Pearl Harbor Naval Shipyard. It is estimated that a minimum of 15 percent of our time and money is spent on rework alone. If our experience is typical of the eight public shipyards that employ approximately 60 000 people, this means that the equivalent of 9000 or more people (that is, the equivalent of another shipyard) are doing nothing but rework full-time. At the same time, tremendous savings can be realized by reducing work and improving processes that produce an acceptable product without rework. Although most current processes eventually produce a quality output, they are very costly, overly complex, and include too many bottlenecks and inspection points. Obviously, all processes must be streamlined to reduce the excess fat. These two elements, reducing rework and streamlining processes, are the key areas to focus on in process improvement.

5. The impact of Japan: Japan has become the exemplar in the world for quality and productivity. The Japanese have excelled at being able to produce a product or a service and doing it right the first time. They have set the example for continuous improvement. Their ability to reduce variation in a process and produce uniform output has resulted in higher quality and reliability and a minimized cost by eliminating rework.

The evolution of quality

In the 1930's, Walter Shewhart, a statistician at Bell Laboratories in New York, developed techniques to bring industrial processes into what he called "statistical control." Shewhart, through the use of statistical analysis techniques, established a method for defining the limits of inherent or random variation in a process. Once the variation was determined, process control limits were mathematically determined. From this, a process control chart could be constructed which would provide a real time measure of process variability as work was being performed. By collecting in-process measurement data at selected intervals and entering it on the control chart, the actual performance of the process could be tracked. Review of the control chart could then trigger action to adjust or modify the process if it began to deviate from the norm and thereby prevent the production of a defective product. Workers could be trained to do this charting themselves, thus giving them greater control over their jobs and allowing them to make adjustments on their own. Dr. Deming studied with Shewhart and included these theories on quality control as a basis for his own work. The theories were put into practice during World War II, and the result was our ability to produce a quality product from the assembly line without the need for 100 percent inspection. Because of the resulting increase in productivity, we were able to provide the forces in the field with the quantity and quality of materials needed in the war effort; a significant factor in our eventual victory. After the war, however, the high consumer demand for products placed the emphasis on quantity, not quality; therefore, Shewhart's theories were no longer seen as important. Paradoxically, General McArthur, who was assisting Japan in the rebuilding process, invited Deming to help with the census. While Deming was in Japan, he was also asked to present his ideas on *quality* to the Japanese Union of Scientists and Engineers (JUSE). The rest is history. The Japanese accepted these ideas and began massive training in statistical methods. Since 1950, the Japanese have become one of the world leaders in quality and productivity and a major competitive force in the work marketplace. It was not until the 1980 presentation in the United States of the NBC White Paper, "If Japan Can, Why Can't We?" that American business took serious notice of Dr. W Edwards Deming and his 14 principles of management philosophy. Since 1980, many of the Fortune 500 companies have embraced the Deming principles and have improved their quality and productivity significantly.

The evolution of quality improvement at Pearl Harbor up until 1981, for the most part, was seen as the responsibility of the Quality Assurance Department. Like many organizations across the country, Pearl Harbor had made a token effort in support of the "Zero Defects" program in the 1970's. This program was a good example of the slogan approach to quality improvement with no plan of action nor a defined methodology on how to reach this goal. In 1981, in an attempt to apply a methodology, the shipyard initiated a Quality Circle (QC) program and within 1 1/2 years had expanded to 35 active circles. However, due to a lack of *constancy of purpose*, lack of management support, and changes in upper level managers, the number of active circles dropped to two in 1984. Again, due to a change in top management in 1986, the QC program was revitalized and is currently at 20 active circles. In 1984, another Quality Improvement Initiative was established to address the issue of rework. This program later became known as the Problem Recurrence Elimination Program (PREP). The PREP coordinators were assigned in the various shops and departments, and a system was established to identify and record rework along with a computerized database for tracking. This program grew, gained manager and shipyard support, and is both active and very successful today. The databank is used to direct shipyard improvement efforts which have resulted in millions of dollars saved.

The current Shipyard Commander, Captain Robert Traister, arrived at Pearl Harbor Naval Shipyard in January 1986 and brought with him a background of experience at Electric Boat, Litton Industries, and Puget Sound Naval Shipyard. He was familiar with the processes and problems associated with the building, overhaul, and repair of Navy ships. Although these shipyards had different strengths and weaknesses, all had been caught up in fighting fires on a daily basis. Unfortunately, it was his opinion that they had failed to make any significant improvement over the long range. He saw occasional successes, yet all shipyards lacked overall effective planning and coordination. They were bound up in unnecessarily costly processes.

However, one element of the operation which he found successful was the "tiger" or "project" team approach. These teams were made up of a relatively small number of key people with the necessary experience and background to work on a specific task. They would meet periodically on their special assignment and perform the detailed planning and then ensure the project was correctly managed during the execution phase. They were able to continuously identify unforeseen problems and then readily resolve them. This project approach is used successfully today not only at Pearl Harbor, but in all shipyards in order to focus work groups on complex tasks and evolutions. It is an example of a technique that works. Many of the factors that make this approach successful are included in the Deming Philosophy.

Captain Traister was well read in the management philosophies of Drucker, Juran, Deming, and Crosby. He was absolutely convinced that "process improvement" was a necessary part of the long-term shipyard improvement equation, and he initiated a shipyard-wide effort in process management. By April 1986, he issued written direction to all departments and offices making it clear that he wanted everyone in the shipyard involved in process improvement. An enclosure to this internal direction was a 55-page guide that outlined the "Management Approach to Productivity Improvement."

Shortly after that, 22 top managers attended a five-day course given by the University of New Hampshire entitled the "Group Approach to Problem Solving (GAPS)." Immediately following this, another group of 22 top managers attended another five-day course given by the National Sum-

mit Group entitled "Quality, Productivity and Implementing SPC." Following the training, a Steering Committee of Department and Offices heads as assigned to establish and manage future process improvement policy and direction. The Steering Committee made two key decisions: (1) to hire an outside consultant for one year to assist the shipyard in its implementation efforts and (2) to develop an internal education program to train project teams and managers in the problem-solving tools and techniques. The training program was to be an interim step to get the remaining shipyard managers trained and involved in process improvement until the consultant arrived. By the end of 1986, 12 interdepartmental teams and 375 managers and supervisors had been trained. The idea was that managers/supervisors were to put these tools to work in finding and solving problems in their own work area (Deming's Point No. 5: Find Problems). A sub-steering committee was assigned the task of writing a solicitation to hire an outside consultant. The completion of this process took one year.

Implementation—Phase I

This section describes the process improvement structure established by Captain Traister and the Steering Committee and covers the period of 1986 to 1987. (Phase II begins with the arrival of the consultant in June 1987. The structure incorporates all the elements that go together to make the implementation process work; moreover, these elements integrate the ingredients of the Deming philosophy into continuous process improvement. This structure evolves and changes continually as it is refined and improved through actual use at Pearl Harbor. This paper is a description or "snapshot" of where Pearl Harbor currently is in this process. Some of these elements were already in place while others have been added since the recent emphasis on Total Quality Management (TQM) began. Due to a lack of publicity, the program has been seen as "quiet", therefore, one drawback is that the workforce perceives fragmentation as these old programs now merge with new elements. A description of each element is provided below.

Shipyard commander

The Shipyard Commander, that is, the Chief Executive Officer is the most critical element in causing continuous process improvement to take place. He is the role model for others to follow. Without his commitment, dedication, belief, involvement, support and constant everyday pushing of the program, any effort such as this one is doomed. For example, Captain Traister has participated in all 25 training sessions conducted to date. In these sessions, he spends considerable time explaining to each class of 25 shipyard managers why this process is necessary and how it works, and he gives examples of its success. In addition, he attends and chairs two one-hour process review sessions each week where presentations are made on process improvements throughout the shipyard. Each week he chairs the Steering Committee, which provides direction and guidance for the TQM program. He constantly queries managers and those directly involved in improvement projects with questions such as

"What are the criteria?"
"What will you measure?"
"How will you know if you have improved?"
"You need more data."
"You must establish a database."
"What is your plan to follow up?"
"You need to break the job down into smaller pieces."
"Why does our procedure cost more than other shipyards?"

Managers and supervisors who have received the benefit of the training all agree that the Shipyard Commander is a

critical element in Deming's "transformation." From the top down, the total process needs to be both stated *and* used repeatedly throughout the entire management structure in the shipyard

Steering Committee

The Steering Committee's purpose is to establish policy and direction for TQM It is chaired by the Shipyard Commander and meets weekly for 1 1/2 hours. Its members include some 25 managers, made up of department and office heads in all major functions. This Committee identifies high-cost processes for review and assigns interdepartmental members to work on these projects. Steering Committee activities have included viewing the Juran, Conway, and Deming videotapes, and arranging for guest speakers that are further along in implementing the Deming principles. One month was spent reviewing all process improvement projects underway in each department This thorough overview gave everyone an opportunity to see what is going on and to provide feedback. The Steering Committee works closely with the consultant in developing a clear understanding of Deming's 14 points. Subcommittees will be formed to study a specific number of the 14 points, and they will define them operationally and functionally within the shipyard Through this process, the Steering Committee will become the champions of the 14 points, moreover, they will become a resource and resolver of any questions regarding these principles

Rework

The Problem Recurrence Elimination Program (PREP) has been actively involved in identifying rework for three years. PREP is composed of 12 full-time and 12 part-time coordinators assigned from the various shops and departments. These coordinators have been trained in process analysis and improvement, and spearhead projects that have been identified as rework problems.

Plans for the future include on-going documentation of discrepancies on critical submarine components and systems These discrepancies will be documented during assembly, shop and shipboard testing This enormous databank will be used to

- identify problem processes
- prioritize process improvements needs and efforts
- confirm effectivenes of process improvement actions
- demonstrate process control effectiveness

By continually improving shipyard repair processes, the shipyard will be able to reduce the number of problems, maintain a corporate memory databank, and get repair processes under control

Training

Deming emphasizes a continuing training and education commitment for all employees.

The employees must understand the total assigned job, requirements, procedures, and policies. Most important, the employee must be given the opportunity to apply classroom training in the workplace so that the knowledge and understanding is internalized In other words, the employee must be qualified to do the job. Training must be continually improved and updated to meet changing requirements, and the shipyard must allocate resources to fund this training. Statistical methods are used to determine if processes are in control and if training is needed. To achieve this training goal at Pearl Harbor, an interdepartmental team was established to set up a Skills Tracking System. This system lists the skill and training requirements, the dates that training was last attended, and the jobs that were worked where training was applied This system will be used, along with the workload forecast, to determine future and on-going training requirements.

This section describes training that the shipyard developed to get started in process improvement. The purpose of this training was to train interdepartmental project teams and shipyard managers in the Deming Philosophy, problem-solving, team building, and statistical methods. It was initially seen as a three- to four-month interim action before the consultant arrived; however, as it turned out, it was a one-year effort. During that one year, 19 interdepartmental project teams and 600 managers were trained. Since the overview training was limited to three days, it provided only an introduction to shipyard managers on the basic concepts It was presented in a top down approach, that is, managers should not attend unless their supervisor had attended first This unwritten rule was about 70 percent effective. Class size was limited to 20 to 25 people.

Subject matter included introduction, background, the Deming video entitled "Road Map to Change," Shipyard Commander's presentation, working as a group, defining and understanding the problems, flow charting, cause and effect diagrams, data collection, data analysis, pareto, trend charts, histograms, scatter diagrams, control charts, solutions, and a six-hour group application of the problem solving tools to a case study. In addition to this training, six shipyard managers were sent to a four-day seminar given by Deming himself in May 1987.

Process review

Currently, approximately 100 improvement projects are being tracked and monitored. This number is increasing as managers and supervisors begin to identify and attack problems in their own areas. At the present time, the Shipyard Commander, the Planning Officer, and the Production Officer hold a Process Review meeting every Wednesday and Friday between 0700 and 0800. Presentations are made on the progress of improvement projects and top management has the opportunity to provide approval, feedback, and direction at these meetings. With this meeting, the Shipyard Commander is modeling what he wants to eventually see at the shop and department level. As the number of improvement projects continues to increase, each shop and department will establish its own internal Quality Assurance Program or Quality Review Board. These Boards will be responsible for reviewing improvement projects to ensure they are progressing and receiving necessary management attention.

Interdepartmental teams

Shipyard operations involve many complex and costly processes. These processes require input from numerous trades and codes throughout the shipyard because they cross department boundaries. These processes are further complicated by their own undocumented evolution and by the many imposed governmental regulations. The Steering Committee identifies not only the high-cost processes, but also the ones which continually result or hinder productivity year after year. These processes are pinpointed as potential projects for improvement, and they represent major cost savings. Once the Steering Committee selects such a project, the next step is to nominate a project manager from the Steering Committee to be responsible for the project. The project manager serves as a link between the team and the Steering Committee, and he or she provides status to the Steering Committee on the team's progress.

The project manager selects a team leader, and the two together determine the required trades and codes that are needed to resolve the problem Once the team members are

identified, the entire team attends a three-day training in the Deming Philosophy, problem-solving tools, and Statistical Process Control (SPC). After completing the training, the team spends the remaining two days getting started on their project From here on, the team averages four hours per week working on their projects. Typically, they hold two meetings per week for two hours.

These interdepartmental teams incorporate all the ingredients of the Deming Philosophy, that is, breaking down barriers between departments, two-way communication, and managers demonstrating their leadership ability by helping to remove barriers that hinder the team's progress and success. These teams exemplify how process improvement works for other shops and departments. They are a vehicle that allows the shipyard to experience the Deming principles at work.

Nineteen interdepartmental teams have been established at Pearl Harbor to work on the following high-cost processes:

- Scheduling
- Steaming Deficiencies
- Special Hull Treatment
- System Certification
- In-Place Valve Repair
- Electricity Usage
- Discrepancy Reports
- Key Operation Closure
- Controlled Industrial Material
- Steam Plant Cleanliness Control
- Design Support Services
- Material Kitting
- Shift Turnover
- ATMAS
- Refrigeration
- Skills Bank
- Test Memos
- BQQ5 Upgrade
- Clean Van

Typically, a team will make a status presentation to the Process Review Board one to three months after they complete training. This gives management an opportunity to ask questions and provide feedback. The final presentation is made when the team is ready to implement their improvement action. After management's approval is received and after the changes are implemented, the team follows up to ensure that the plan of action is implemented properly. They also collect data to ensure that the improvement works and meets the desired goal. *Only* when the team has institutionalized the change can it step away from the project.

Departments

The Shipyard Commander has tasked each Department to identify and work on five improvement projects and to report the status to him quarterly in writing. Each department identifies high-cost problems in their area and assigns team leaders and members to attack those problems. Several departments have established more than five projects. The awareness of the opportunity for fertile areas to improve becomes more and more apparent.

Managers and supervisors

The *model* for individual managers and supervisors is to spend 10 percent of their time (four hours per week) dedicated to process improvement. This means meeting with their subordinates, their counterparts plus managers, or both to identify problems. This becomes a schedule and behavior that is on-going for constantly improving processes by identifying and eliminating problems one by one.

Currently, very few individual managers/supervisors are involved independently other than in the projects discussed above. More and more pressure is being directed toward getting all personnel trained actively involved. Pearl Harbor has trained more than 600 managers to date, but only a handful are involved in improvement projects.

This is a weak area in that managers and supervisors are not applying the tools and techniques learned in training; therefore, their ability to internalize these skills is jeopardized.

Quality Circles

The Shipyard Commander's goal is to get all the managers and supervisors trained and onboard with the Deming Philosophy and "process improvement" *before* addressing the workforce regarding Quality Circles. The point is that the Quality Circle program that began in 1981 had little or no management support. Before the shipyard establishes any future Quality Circle policy, all managers must first be trained and actively involved. It is important that managers and supervisors understand the Deming Philosophy and process improvement before the concept is introduced at the workforce level. Every effort must be made to eliminate lip service.

Implementation—Phase II

Phase II began with the arrival of the consultant in June 1987. Up to this point, the shipyard established a system and structure to get "process improvement" underway. Although slow in development, the shipyard moved steadily and positively toward getting everyone involved. The Deming principles were addressed superficially. The videotape "Road Map to Change" (Deming Philosophy), had been shown to all managers and discussed briefly in the three day training.

Why a consultant?

Deming recommends the use of a consultant and, of course, consultants recommend consultants. The shipyard made the decision early on to bring in outside assistance for the following reasons:

1. The payback from the expected cost savings will more than compensate for consultant's service.
2. Pearl Harbor lacks "hands-on" experience in applying statistical methods and the Deming principles.
3. Consultants offer expertise, credibility, and direct "hands-on" experience that will provide a faster and smoother transition.
4. Consultants have encountered and dealt with the barriers and pitfalls of implementation and developed strategies to minimize these problems.

The following criteria were used to evaluate the background and experience of the contractors and the personnel involved in the project:

- teaching experience/expertise,
- problem-solving and team building,
- statistical process control,
- Deming principles,
- record of successful implementation,
- size and type of organizations served, and
- response from references contacted.

Consultant services

In late May 1987, the contract was awarded to Process Management Institute (PMI). PMI, recommended by Dr. Deming, will provide four different specialists from their staff during the one-year contractual period. The contract includes the following services:

1. Top management: Mr. Louis Schultz, president of PMI will present a three-day seminar to top management at the

shipyard. The title of his seminar is "Managing in the New World Wide Competitive Society." Topics include:
- History of Competitiveness
- Need for Change
- Deming's Deadly Diseases
- Deming's 14 Principles
- Funnel Experiment
- Bead Box Experiment
- Consequences of Staying "As Is"
- Process for Change
- What's Required to Make It Happen
- What We Would Like to See at Pearl Harbor
- Obstacles

This seminar will initiate the contract and provide managers with an overview of their new role.

2. SPC internal consultants: A group of 25 people assigned from the various shops and departments will receive in-depth training in statistical methods. They will be taught to apply these methods to projects within the particular shop or department where they are employed. These "internal consultants" will work with their management and project teams on improvement projects; moreover, they will become a resource in the shipyard to draw from in the application of SPC. The training they receive includes a minimum of one week in the classroom followed by several weeks of applying the SPC tools and techniques to real Shop/Department projects.

3. Project teams: Problem-solving, team building, and SPC training will be provided for selected improvement projects. Upon completion of the training, the teams will work with the internal consultants, their Department Managers, and the Consultants in applying the skills and techniques to specific problem areas. This training covers five days and is followed by the team meeting four hours a week to work on their project.

4. Facilitation and consultation: Continual full-time facilitation on the application of the Deming principles, problem-solving techniques, and statistical methods is required throughout the one-year contract period. The consultant will work with top management, the Steering Committee, Department and Office Heads, the internal consultants, and the project teams. This hands-on application phase is a critical step for managers to internalize all aspects of the Deming Philosophy.

Results and examples

Pearl Harbor's progress will be assessed in two areas: reduction in cost of SSN 688 Class overhauls and implementation of a process management system.

SSN 688 Class overhaul costs

Pearl Harbor has completed two SSN 688 Class overhauls, has two currently in progress, and has two more planned for the future. Man-day expenditures exceed those of other overhauling activities by the percent shown in Table 1.

The shipyard is committed to reducing costs and the time to overhaul SSN 688 Class ships. Only by attacking the costly and time-consuming processes, project by project, and getting everyone involved can the shipyard achieve its goal. As shown by the figures in Table 1, the shipyard is making progress and still has a long way to go.

Significant improvement projects

Pearl Harbor's strategy on specific high-cost SSN 688 Class processes is to:

1. Identify high cost job orders by comparing our costs with the Naval Sea Systems Command (NAVSEA) Cost Estimating Standard (CES) and those of other shipyards.

Table 1 SSN 688 Class overhaul costs

SSN 688 Class Overhauls	Man-Day Expenditures in Excess of Other Shipyards, %
First (1984)	25
Second (1985)	22
Third (1986)	16°
Fourth (1987)	11°

°Projected.

2. When appropriate, break down the costs of the large complex processes into smaller segments to determine where the higher costs are originating.

3. Assign a project team of managers close to the process to streamline it and eliminate the excess fat.

The above approach is best exemplified by the Special Hull Treatment process. The shipyard has recently completed its first of six scheduled ships. Cost figures are significantly less than original estimates and are below all other activities involved in this process. At the 70 percent completion stage, the second ship cost indicators suggest further significant reductions in total cost. Pearl Harbor has set an example for this process in the ship repair and overhaul industry. Reasons for this success include:

1. The work was packaged into nine zones that allowed accurate tracking of costs. Accurate and honest charging was achieved; this allowed the process to be controlled.

2. A project team was established early on to improve this process. The process was flow-charted extensively to better understand how the process worked and determine where improvements could be made. Improvement actions have been implemented and significant cost reductions have been documented.

3. People close to the process have created an on-going process improvement attitude that has developed a pride that fosters continual improvement.

The examples in Table 2 are SSN 688 Class processes that have been identified and had project teams assigned. For those that have implemented at least one improvement action, cost reductions of 10 to 100 percent have been documented. Taking all improvement projects into account, approximately $15 million in actual savings and $30 million in cost-avoidance have been recorded. Further cost reductions are anticipated on these processes on future ship overhauls as the shipyard maintains its commitment to continuous improvement. Eventually, problem prevention and continual improvement will become a way of work life for all employees.

The projects listed in Table 2 are only a sample of the 100 to 120 improvement projects currently in progress at the shipyard.

Implementation of total quality management

The goal is to actively involve all employees in the con-

Table 2 Example project job order titles

Design services
Design support
Fire watch services
Certification
Built-in tanks
Air-conditioning
Hatches
Propulsion lube oil flush
Lighting
Ship's service motor generator
Oxygen system

tinual pursuit of quality improvement in shipyard processes. This new management style is modeled by the Shipyard Commander and the Steering Committee downward into each Department and Shop. In the same way, the Department Head meets weekly with senior Department Managers to identify and work on quality problems under their responsibility. Problems are defined, prioritized, quantified, and flow charted. Data are collected and analyzed, and decisions are made based on facts. Causes are identified and verified, and corrective action is implemented. To ensure that the actions are implemented to their satisfaction, tracking and monitoring is initiated. Further, data are collected to ensure that improvement in the process actually occurred and that gains are held. This Departmental Management Team becomes the example and steering arm for process management to evolve downward into the middle management level. As other managers and employees see top management actively participating, and as this evolutional process continues, the entire workforce will eventually become involved in and committed to continuous involvement and thereby ensure the ultimate success of the shipyard.

To date, the Steering Committee and the Process Review Board are the two driving forces molding the Process Management System in the Shipyard. Shops and Departments review their improvement projects before they are presented to the Process Review Board. Not all Department Heads and Senior Managers meet on a weekly basis. Middle management participation is still fragmented at this stage of development, and it includes involvement on interdepartmental and department projects. The current number of 100 to 120 improvement projects represents involvement of about 10 to 12 percent of shipyard employees. As yet, no concerted effort has been initiated at the workforce level. Once all managers have been trained and are actively involved, then the workforce will be addressed. Currently, 600 of the 800 shipyard managers have attended the three-day basic introduction.

Areas for improvement

As the shipyard takes advantage of the outside consultants' expertise, the following areas will be addressed in greater detail:

1 Statistical methods: The internal consultants will learn statistical methods in depth and begin to apply them in their shop or department

2 Union: The relationship between management and the union is seen as adversarial and requires considerable improvement. Steering Committee members have been appointed to discuss union concern with anticipated changes resulting from policy to proceed with the program. It will require that the union be kept well informed regarding process improvement changes that affect the workforce. Several union officers have attended the training program and have agreed with the direction.

3 Deming principles: The Steering Committee plans to establish subcommittees to address the 14 points in detail. In particular, hard spots will be identified as they relate to the rules and regulations that exist in the Federal and Navy systems.

4 Constancy of purpose: In order to prevent the constancy of purpose from being jeopardized by the eventual reassignment of the Shipyard Commander in the summer of 1988, it is critical for the Steering Committee to ensure that the program survives the transitional nature of military managers at the shipyard

Conclusion

People close to the implementation process inside the

Shipyard see the effort moving forward very slowly; authoritative sources outside the shipyard believe the shipyard is moving too quickly. From 1987 to 1988 there will be a major thrust forward because the outside consultant will be assisting the shipyard full time. Top management will tackle the 14 points in detail, and the 25 "internal consultants" managers trained in SPC will apply statistical methods in their departments. In addition, new project teams will be formed and trained by the consultant. Therefore, the expectation at this time is that through the combined efforts of all these groups, the pacing between theory and practice will become more balanced.

There is no turning back. Pearl Harbor Naval Shipyard must reduce costs and be competitive to stay in business. A new management style is evolving, but not until future cost indicators are evaluated and full employee participation is realized will the extent of the success of the effort be known

Additional resources and bibliography

Video Cassettes (Rental/Purchase)

University of Michigan
Transportation Research Institute
2901 Baxter Road
Ann Arbor, MI 48109
ATTN: AVMAST Library Coordinator
Phone: (313) 763-2465.

ED18 "Statistical Techniques for Quality and Productivity in the Shipbuilding Industry (Session 1)."
ED19 "Statistical Techniques for Quality and Productivity in the Shipbuilding Industry (Session 2)."
ED20 "Statistical Techniques for Quality and Productivity in the Shipbuilding Industry (Session 3)."
ED21 "Statistical Techniques for Quality and Productivity in the Shipbuilding Industry (Session 4)."
ED22 "Dimensional Accuracy Control and Statistical Methods."
DE2 "A Call to Arms by William Conway."
DE3 "Why Productivity Increases as Quality Improves."
DE4 "The 14 Steps Management Must Take. Part I."
DE5 "The 14 Steps Management Must Take. Part II: Obstacles to Success. 1."
DE6 "Obstacles to Success. II."
DE7 "Uses of Control Charts."
DE8 "Discovery and Correction of Faults of the System. Part I."
DE9 "Discovery and Correction of Faults of the System. Part II."
DE10 "New Principles of Training and Supervision (I)."
DE11 "New Principles of Training and Supervision (II)."
DE12 "Quality and the Consumer Inspection of Incoming Materials and Products, I."
DE13 "Inspection of Incoming Materials and Products. II."
DE14 "Quality and Productivity in Service Organizations."
DE15 "Operational Definitions, Conformance, and Performances."
DE16 "Dr. Deming Discusses Quality and Productivity with Dr Myron Tribus."
DE17 "William Conway, President, Relates the Nashua Corporation's Experience."
DE18 "Action Plans for Implementing Quality and Productivity (Part 1)."
DE19 "Action Plans for Implementing Quality and Productivity (Part 2)."
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USN43 "Quality Circle/A Time for People Building and Management Support."

Other Available Videotapes

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Discussion

E. Chandler Shumate, Navy Personnel Research and Development Center

A transformation in management. The most significant contribution of the Damon paper to managers seeking to adopt a quality approach to productivity improvement and cost reduction, based upon the Deming philosophy, is the reaffirmation that successful implementation is dependent upon an *organization-wide, cultural change*. Top- and mid-level managers must realize that they must change the way they manage. Ishikawa (1985) describes this change in managerial style as "a thought revolution in management." Moreover, the primary "aim" of Deming's most recent book, *Out of the Crisis* (1986), is to provide direction for a "transformation" of the American style of management.

Many American managers currently in the process of implementing a Total Quality Management (TQM) approach based upon the Deming philosophy believe that the effective implementation of TQM lies with the introduction and use of statistical methods. While the day to day application of statistical methods will certainly be required later, the most important event that must take place at the outset is a *consensus*, not a compromise, by top- and mid-level managers that (a) a change in managerial behavior (style) is necessary and (b) continuous quality improvement is the correct approach to productivity improvement and cost reduction. Damon's paper indicates that he and the Commanding Officer (CO) understand these requirements, but it is not clear that there is such an understanding, nor a consensus, among the shipyard managers as a whole, particularly middle managers, given that more than 600 managers have been trained but "only a handful are involved in improvement projects."

In any organization, it is unlikely that every manager is going to embrace the quality approach to productivity improvement and cost reduction. However, a "critical mass" (sufficient to begin and sustain a change) of managers favorable to the approach must be identified and set to work on process improvement if the effort is to be successful. In spite of his good intentions and hard work, the CO cannot implement TQM by himself, he needs a critical mass of both top- and mid-level managers. An important consideration for the shipyard might be to develop a method for determining the level of commitment to TQM by its managers. Such a method, applied periodically, would provide guidance for de- termining where the CO should most effectively direct his attention.

One comment on the training of 600 managers: even when managers are favorable to a quality approach, training them without providing immediate opportunities, resources, and guidance to apply the newly acquired skills is a common mistake in implementing TQM. Such mass training may lead to high expectations followed by disillusionment when opportunities and support are not forthcoming. This situation leads to a "false start" and will not produce effective results. Ideally, training schedules need to be coordinated with an overall implementation plan to ensure that training is provided when it is needed.

As previously stated, managers have to change the way they manage and, as pointed out by Damon, such change does not happen overnight. The shipyard has taken a positive step towards cultural change in recognizing the need to take a long-term (three to five years) perspective. This approach lies in sharp contrast to the "quick-fix" mentality that is characteristic of bureaucratic organizations. It should be noted, however, that the shipyard's long term goals will be attained only if its managers begin now.

Damon also correctly points out that the transformation requires not only a change in *attitude* but a change in *behavior* as well. He sites the importance of managers becoming role models and changing "fundamental ideas about how to manage shipyard work and its role with the people." However, the paper is not clear about what that means. For example, Deming states that the role of the manager is to work with people, to help them do their work, to serve as a coach rather than as a judge. Do the managers at Pearl Harbor perceive their role as helping their subordinates, actually working with them on process improvement efforts, or do they simply listen (hold periodic reviews) to reports from week to week and pronounce judgments? What are the enforcing mechanisms (performance evaluation, reward systems, etc.) for getting a manager to actually change his or her management style? How will the shipyard know if this change is occurring? What will the indicators be? What can be done to facilitate change? These are tough questions, they involve measuring attitudes and perceptions. Nonetheless, they need to be addressed.

Deming cautions managers against delegating their re-

THE DEADLY DISEASES

1 Lack of constancy of purpose to plan product and service that will have a market and keep the company in business, and provide jobs

2 Emphasis on short-term profits: short term thinking (just the opposite from constancy of purpose to stay in business), fed by fear of unfriendly takeover, and by push from bankers and owners, for dividends

3 Performance appraisal systems which establish objectives or goals but lack a clear method for meeting the goal; that instill fear, and discourage or eliminate needed teamwork.

4 Personnel practices that encourage job hopping by management and labor.

5 Managing in accordance with visible figures only.

THE DREADFUL DISEASES
(easier to cure but just as disruptive)

1 Turning to other organizations for examples of how to solve problems of quality.

2 Management training that emphasizes creative accounting rather than commitment.

3 Purchasing standards that assume a certain percentage of defects

4 Management's delegation of its responsibilities to others.

5 The supposition that problems are the fault of the work force.

6 The attempt to safeguard quality by inspecting goods already produced

7 False starts modest, ad hoc efforts to bring about change rather than an organization-wide commitment to a new way of working

sponsibilities to others. A prime example occurs when a manager assigns one or more of his subordinates to take care of the quality program and report back from time to time to keep him informed. If a manager is not sincerely interested in process improvement and does not actively participate with his people, a negative signal is sent, loud and clear, to lower level managers, supervisors and the work force that this is just another program rather than a *new* way of doing business as they were initially lead to believe. If managers do not openly exhibit change, there is little reason to expect anything different from the rest of the work force

A Road Map? Damon makes the point that Deming "does not tell us how to make this transformation" but does provide 14 management principles to serve as guides for managers. While it is true that Deming does not provide a step by step plan, he does provide additional guidance in the form of what he refers to as "The Deadly Diseases" plus a number of obstacles that "stand in the way of transformation" and must be cured by management. Seven such obstacles are referred to as "The Dreadful Diseases" (see Table 3 for a list of the Deadly and Dreadful Diseases). Therefore, to implement a Deming approach to quality improvement and bring about a transformation in management style, it is managements new job to (a) implement the Fourteen Management Principles, and (b) work towards eliminating the Deadly and Dreadful Diseases

Organizational structure. The article describes several different organizational entities (for example, Steering Committee, Quality Circles [QC], Problem Recurrence Elimination Program [PREP], Interdepartmental Teams, Department Teams, Quality Review Boards, Tiger Teams, Project Teams). It is difficult to get a clear perspective of how these groups interact or are related to one another in the context of TQM. It is understood that a shipyard is an extremely complex organization and that many different activities occur concurrently; however, it might be wise to attempt to integrate the various activities in a single strategic implementation plan with clear objectives, roles, reporting requirements, and a description of the inter-relationships between the various programs. As described in the paper, the

process improvement effort may be perceived by the work force as fragmented, lacking clear purpose and thereby suffer a loss of credibility. This problem may be particularly troublesome given the shipyard's decision to maintain a low level of visibility to the work force. A lack of information spawns a raft of rumors, mostly unfavorable.

SPC internal consultants. Any large organization, such as a shipyard, attempting to implement TQM will, in time, require a permanent, full-time statistician and adequate staffing to teach and advise on the application of Statistical Process Control (SPC). Deming is very clear on this point:

> No one should teach the theory and use of control charts without knowledge of statistical theory through at least the master's level, supplemented by experience under a master. I make this statement on the basis of experience, seeing every day the devastating effects of incompetent teaching and faulty application. (p. 131)

Pearl Harbor has selected a group of 25 people from the various shops and departments to "receive in-depth training in statistical methods." These "internal consultants" are expected to apply SPC methods to projects in their own departments and to serve as a resource in the shipyard to draw upon in the application of SPC. The only point to be made here is that, in light of Deming's position on the matter and my own experience, it would be unwise to expect much help from these folks unless they get a great deal more training than outlined in the paper "one week of classroom training followed by several weeks of applying the SPC tools and techniques to real Shop/Department projects." Performing the role of a consultant not only requires an expert knowledge of the content area, in this case a rather difficult subject matter (SPC), but also a knowledge of consulting skills as well which are not easily nor quickly learned. The described training is clearly insufficient. The internal consultants could certainly be useful in some limited capacity, but that limitation should be specified up front. If not, there will be serious frustrations experienced by both the consultants and those they are called upon to help. This kind of situation could jeopardize the implementation. The shipyard should seriously be looking for qualified statisticians. Some eligible candidates may currently reside in the organization and, with additional training, could be helpful.

Finally, regardless of how well internal consultant may be trained (unless they become "masters" as defined in Deming's latest book), maximum effectiveness requires the assistance of a "master" statistician. In a recent discussion on the topic (a Round Table discussion sponsored by the San Diego Deming Users' Group, 13 Aug. 1987), Deming stated that an organization without a "master" statistician should try to find one to come in at least once a month to consult, follow-up on previous work, and assess progress.

Process versus problem. This paper (if I understand it correctly) describes what I believe to be one of the best efforts at implementing TQM in an industrially funded public organization. Most of the important concepts are addressed and the work thus far is a credit to its designers. Although the phrase "process improvement" is used quite often, I have an overall impression that the effort places more emphasis upon problem solving than process improvement. The "Tiger Team" concept has been around for a long time, but it represents the old way of managing, basically throwing the best and brightest at a problem until a solution is obtained I would simply like to offer a caution that problem-solving although required, does not reflect "management's new job"

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Frank G. Peals, Mare Island Naval Shipyard

It's very apparent from the paper that Pearl Harbor Naval Shipyard is very serious about the Total Quality Management Process. They have committed a great deal of time and resources to this process. However, based on my experience, I think the presenter is somewhat optimistic in his projection of three to five years to change attitude and behavior. I think that because of the size of Pearl Harbor Naval Shipyard, it can be reasonably expected that this process will take at *least a decade* to reach maturation.

I commend the shipyard's efforts to research and explore many alternative sources of knowledge, such as Dr. Deming, Dr. Juran, and Phil Crosby. The shipyard seems to have taken from each of these sources what applies to its individual needs and has developed a customized process while using the Dr. Deming 14-point approach as a basic model.

I feel that awareness of need and training is the key to successful change. Pearl Harbor should be commended on its efforts in these areas. Shipyard management is aware that the shipyard must improve to be competitive in today's market and is providing the resources needed to train managers in the process improvement techniques. However, a continuing effort to push this training down into the organization is needed.

I'm somewhat disappointed that there was so little discussion in this paper on the quality circle process at Pearl Harbor. I think that quality circles can and should be an integral part of any total quality management process. Quality circles have the required training to identify, analyze, and solve quality problems. I think that management can effectively utilize these teams to attack quality problems while at the same time respecting their autonomy. I do agree, however, that additional circles should not be established until management training is complete and management is actively involved.

Pearl Harbor should use great care in selecting projects for its task teams. It has been my experience that the success of the project teams is greatly enhanced if the projects may be solved and solutions implemented within a single shop or code. Projects that cross organizational boundaries are extremely difficult to solve and the solutions are extremely difficult to implement.

Based on the discussion in the paper and item No. 2 in areas for improvement, I think that Pearl Harbor should get more labor involvement in the process. One method that may be considered to do that is to have labor represented on the steering committee and the subcommittees.

To conclude, I think that Pearl Harbor has a strong management commitment to the total quality management process. The shipyard has committed the resources needed and is showing tangible results. The use of an outside consultant should help them stay on track and overcome many of the roadblocks they will encounter.

However, to sustain this process for the long term and actually achieve an organizational culture change, middle management must be *committed* and *involved* in the process. Moreover, labor *involvement* must occur. It appears that Pearl Harbor recognizes this and is working very hard to address these potential problems.

Howard M. Bunch, The University of Michigan

When a paper describing a project at a U.S. Naval shipyard starts by saying "The goal ... is to reduce costs in order to *remain competitive* [italics added] ..." you know that you're on to something! And Mr. Damon's description of the imple-

mentation of total quality management at Pearl Harbor Naval Shipyard didn't disappoint me, for two reasons. First, I'm impressed with the new emphasis on costs that has become a major driver of managerial decisions in the public shipyards. And, second, the described project is, in my opinion, the most comprehensive and well-conceived attempt to emplace the Deming philosophy of managerial thinking into a U.S. shipyard—public or private—that I have encountered.

I have had the opportunity to observe first-hand the development of the program described by Mr. Damon, and that exposure has convinced me that the project *will* be a success because it has the four essential ingredients that are required to attain that goal. It has the *absolute* commitment of support from the shipyard commander; he has shown by word and action that his commitment is unequivocal. Second, the planning for implementation was deliberate and well planned; the paper presented by Mr. Damon reinforces the on-site impression. Third, the planners had the good sense to bring aboard a consultant—Process Management Institute—who has significant experience in emplacing into an enterprise the Deming management philosophy. The consultant has provided the shipyard with important knowledge and confidence necessary to maintain enthusiasm at all times. And, finally, the program is being guided by a group of departmental teams comprised of acknowledged peer leaders from throughout the shipyard. Every level of management and worker is represented on the teams.

As was noted in Mr. Damon's listing of "Additional Resources" there are large amounts of material available for use by a person interested in obtaining more knowledge about the Deming philosophy, and statistical techniques associated with use of the philosophy. He listed most of the approximately 20 to 25 video cassettes (and associated instructor's manuals) from the NSRP _ ication and Training Panel's AVMAST library at The U ⁓ ity of Michigan. Additional tapes have been added in ⸱ast few months, and the library is being constantly expanded. The tapes are available, on a loan basis, to any U.S. shipyard, design agent, or university for about $15 per tape. (The charge is only to recover costs of postage and handling associated with sending the material to the user.) In addition to the videotapes, a number of reports, available in microfiche form, are also available from the AVMAST library. The charge for this material is also nominal. Hard copies of the reports are also available without charge if the library has surplus copies in inventory. (When there is no surplus, there is a charge for photocopying the report.) Interested persons are encouraged to contact the University of Michigan AVMAST Library Coordinator for more information concerning the training support material that is available for shipyard use.

I was impressed during my on-site observation of the program; and I'm even more impressed after reading Mr. Damon's paper. Hopefully, a representative of Pearl Harbor Naval Shipyard will revisit at future NSRP Shipbuilding Symposium at some future time and report further on the program's outcome. I look forward with anticipation to that moment.

Duane Williams, Puget Sound Naval Shipyard

Congratulations to the Pearl Harbor Naval Shipyard for their insightful venture into implementation of Total Quality Management (TQM). Their acknowledgement of the importance of quality to productivity improvement and their willingness to commit substantial resources to institutionalize the Deming philosophy are impressive. Because Pearl Harbor is a public shipyard, this entrepreneural stance is particularly encouraging.

It is important to note that Pearl recognizes that management styles take time to change (three to five years).

however, I believe that a total cultural change will take much longer Case in point, it took Japan approximately 20 years to improve their quality to the level it is today, but I do wish Pearl Harbor a quicker recovery.

We must all address the high cost of rework. Rework has been and still is a difficult thing to identify because of the way we make our work charges. If the 15 percent rework value, referred to in the report, is a realistic figure, the amount of time and money spent is of significant value. Realizing that a portion of the 15 percent rework, perhaps 5 percent to 6 percent. is probably a cost of doing business, the amount of money alone that still could be saved would be in the millions of dollars. This does not take into account the impact on schedule, morale. etc.

The only portion of this report that I found disappointing was in the discussion of the Quality Circles at Pearl Harbor. I had hoped that Mr. Damon would have given *more* insight into the reasons why their Quality Circle program retrogressed as :. did. We would have liked to have seen more detail on what is meant by "constancy of purpose" and "lack of management support." However, we do concur in Pearl's statement that they will not establish any future Quality Circle policy until *all* managers are trained and actively *involved*. Involvement by all levels of management is imperative if employee involvement is to be a meaningful tool in the TQM process

We applaud Pearl Harbor's top-down approach to continuing training and education for all employees. The effort to date shows their commitment to this *vital* step in the cultural change process. and we are looking forward to further information on the training of the workforce in TQM

It is hoped that the culture change will be institutionalized and become a way of life at Pearl Harbor, in the near future, so that when Captain Traister moves on to bigger and better things, the force will *still* be with the shipyard.

The author is to be commended on a thorough report, sufficiently detailed to serve as a guide to other shipyards.

Stephen A. Maguire, Ingalls Shipbuilding

It is encouraging to see full-scale application of the Deming philosophy underway in a U.S. shipyard. It is hoped that the efforts of Captain Traister and the Pearl Harbor Naval Shipyard (PHNS management and workers will be updated periodically and become a model for transition throughout the industry.

The work of W. Edwards Deming is often assumed to relate strictly to quality, being the responsibility of an organization's quality assurance department to implement. In fact, Deming provides a comprehensive management approach to be implemented by every department at every level. The result is long-term success by constantly improving quality and productivity. In our industry this means reducing life-cycle costs through improved designs and workmanship and reducing acquisition costs through improved management and productivity.

It should not be surprising to see interdependancies between the Deming approach and National Shipbuilding Research Program (NSRP) publications dealing with IHI management techniques. A few of these are noted here to encourage further progress by the industry to adopt a comprehensive transition program. Just as it would be ineffective to choose several of Deming's 14 points and ignore the rest, many of the NSRP initiatives depend on each other for their full benefit to be realized.

As the author points out, the ship construction, overhaul, and repair business differs from an automobile production line in that some shipyard jobs are repeated only a few times each year. Shipyard processes. on the other hand. are performed repeatedly, day in and day out. Making shipyard work more like an efficient production line requires that the work be organized to capitalize on these repeated processes.

Group technology categorizes the "sameness" of non-identical parts and allows them to be grouped into families (see NSRP publications *Product Work Breakdown Structure* and *Pipe Piece Family Manufacturing*). A common set of skills. methods, and facilities can then be assigned for their manufacture or installation, leading to the establishment of a process lane (see *Process Lanes Feasibility Study*). Properly managed, the process lane can achieve near-to-production line efficiencies.

A common shortcoming of management is its failure to understand the nature of variation. Use of statistical methods allows differentiation between special causes of variation and common causes. This is important for good management because special causes should be dealt with by specific action, while common causes can only be reduced by improving the system. A frequent management mistake is to take specific action (for example, disciplinary action) in response to the normal variation caused by the system Statistical analysis is required to avoid this mistake and create an environment for improvement.

The grouping of work into families. applying group technology. provides sufficient similarity to allow effective statistical process analysis and control (see *Process Analysis Via Accuracy Control*). Shipyard work evolves into a series of process lanes, or work flows. that can be brought into statistical control. Attention is then applied to effectively managing processes rather than their output after the fact. Standard production methods are developed to suit each process lane, and classical industrial engineering analysis and line balancing techniques can be applied

Predictable work flow improves the accuracy of support tasks such as planning, scheduling and budgeting. Decentralization of control to the process lane level allows real-time adjustments to achieve planned goals (see *Flexible Production Scheduling System*). A "quality-of-support spiral" occurs. That is, standard methods lead to standard results which, in turn, improve the ability to anticipate production needs. Better scheduling allows better support (for example. material, data, manpower), which allows better adherence to schedule, which allows better future scheduling

Quality in production scheduling must be supported by quality in design management and material management Again, group technology contributes in that it encourages standardization, reducing design and material procurement spans. Also, design and material organizations contribute to the quality-of-support spiral when consistent work practices are instituted in process lanes (see *Pre-contract Negotiation of Technical Matters* and *Product Oriented Material Management*). A key element of the latter is the establishment of long term working relationships with vendors, rather than awarding solely on lowest bid (Deming Point No. 4).

Improved scheduling allows work team manning to be held relatively constant. This allows the assignment of working teams with a balanced mix of skills for the job at hand Teams doing repetitive tasks not only work more efficiently, but are a great source for suggested improvements. Productivity, quality, and safety improvements are accomplished through "small-groupism" or "shoshudansugi" (see *Problem Solving Teams in Shipbuilding, Analytical Quality Circles. Product Oriented Safety and Health Management*, and *Organizational Innovations in Shipyard Safety*).

Many suggested improvements require interdepartmental understanding and support for implementation. Departmental responsibilities and lines of communication must be arranged to promote product and process improvement (Deming Point No. 9) (see *Outfit Planning, Integrated Hull Construction, Outfitting and Painting. Design for Zone Out-*

fitting, and many design/production integration publications). The effective exchange of knowledge for improvement requires the cross-training of middle and upper management (Point No. 13) (see *Shipyard Organization and Management Development*)

In this environment the Deming methods can be applied to create a system of constant, gradual and unending improvement by everyone ("kaizen"). Work flow through a process lane allows the assignment of well defined, repetitive tasks so that workers and supervision can learn what is expected at each step in the process (Deming Point No. 6). Workers and supervision learn to apply statistical methods for process analysis and improvement (Points Nos. 5 and 11). Quality is achieved by process improvement rather than inspection (Point No. 3). The true capability of a process can be determined, eliminating the setting of arbitrary goals that demoralize the workforce (Points Nos. 11 and 12). Management learns that 85 percent of the problems are caused by the system, rather than the workforce, and takes responsibility for solving them (Points Nos. 7 and 10). Workers can report and help solve problems, rather than hide them (Point No. 8).

The remaining Deming Points (Nos. 1, 2, and 14) are linked to a top-level management commitment to adopting improved methods, such as those developed by IHI and other students of the Deming approach. The author has demonstrated that PHNS is committed to such a transformation and is well on its way to the stated goals of improved cost and being competitive

In light of the previously illustrated correlations to Deming, one is justified in observing that the majority of work carried out by the NSRP is not actually research in the normal sense of the word. Instead, it is a productivity improvement effort based on the application of proven management techniques to ship construction, overhaul and repair. Today, the primary customer is the U.S. Navy and beneficiary of the savings is the taxpayer. It is hoped that this work will continue to receive the attention and support it deserves.

Wanda McHenry, Puget Sound Naval Shipyard

Pearl Harbor Naval Shipyard is on the right track. They have done some right things in the right way. One outstanding feature is the role model that Captain Bob Traister has become for the shipyard. By his continued personal involvement in the process and his participation in all the training, as well as his meetings, Captain Traister's managers see that he means business. He is showing the strong leadership qualities that were responsible for his selection as admiral. With that kind of leadership his managers are supporting him because they want to be part of a good team. A second outstanding feature of the process is doing training the *only* "right way"—from the top down. Even excellent training will fail if students are not trained from the top down, and this is particularly true when introducing change.

I was pleased to see that "accurate charging" is one of their priorities. While I was at NAVSHIPYD Pearl Harbor, one of my jobs was to run the Position Management Program. After a study of the Planning and Estimating Branch, we tried to convince them that accurate charging was crucial to the planning process, but since no one was interested, it died. I am glad someone else has been able to do what I could only recommend.

I am also firmly convinced that "work packaging" and "zone planning" are crucial to cost reduction. The project management of a zone is also very important to Pearl Harbor's success. Their strategy of breaking down complex processes into small segments in order to determine where the higher costs are originating could be carried another step, as I think it should be. If the "tasks" were identified, they could then

be scheduled and controlled, as well as tracked. To carry that further, if the "tasks" are identified, then the "skill" to do that task can be identified, and during the planning process we could find out if we have personnel available to perform those skilled tasks in the time frame we need them. If personnel are unavailable but there are qualified personnel who are doing lesser skilled work on another job during that time frame, we could do one of several things: find someone else available to do the work requiring less skill and move the qualified employee, hire one, train one (we should have the lead time to do this if done during the planning phase), or borrow one from another shipyard. This would give us many benefits, not just tracking costs.

One of the biggest problems in Planning that I see is we currently schedule *job orders*—not *work*. A job order number does not mean the same thing in every shipyard—nor does it always mean the same thing every time in a single shipyard. Because we schedule job orders, not work, we do not schedule tasks, so we do not know the skills we need. If we identify the specific task, then we can do the rest. It is not enough to tell the Industrial Relations Office (IRO) you need ten more welders unless you can identify the specific skills they need. Not all welders are equal. Because we do not schedule "work" or "tasks," we cannot expect IRO to get us the skilled people we need, because we cannot tell them what we need. We do not know.

In conclusion, Mr. Damon's is an excellent paper with many good concepts, of which I have discussed here only a few.

H. Bruce Bongiomi, Portsmouth Naval Shipyard

I have only recently come on board Portsmouth Naval Shipyard in Kittery, Maine. Being relatively new to the naval shipyard, I passed this paper around to a number of people who have been with the shipyard for a while. They generally agreed that what Pearl Harbor is attempting is in the right direction, but there was an element of cynicism in their comments.

Countering cynicism requires what Mr. Damon pointed out: *constancy of purpose.* Cynicism develops when expectations are raised and then not realized. That is why Dr. Deming says do away with slogans and signs—it is action that is required. This problem is not exclusive to public shipyards. Constancy of purpose in private shipyards has been lost because of the disastrous market with its dwindling order books and tighter bids. Public shipyards do not have this problem as yet, but as private yards become increasingly interested in taking on repair and overhaul work, this situation will change.

Public shipyards have different problems interfering with constancy of purpose. One problem, as Mr. Damon mentioned, is the relatively short terms that Commanding Officers occupy their positions. With turnover of command often comes a change in management philosophy and style. If a leader is replaced by an administrator, a program such as TQM will founder, and high expectations will be unfulfilled. The result is cynicism and even more difficulty in initiating change in the future. One solution to this would be to extend the time an officer is in command of the shipyard. Another would be to install civilian management responsible to the Navy under specific performance constraints. As long as these positions were independent of administration changes, there would be constancy of leadership and, thereby, purpose.

Another problem, related to frequent changes in top management is bureaucracy. Layers of middle managers and staff have been built into the public shipyard organization to provide some measure of constancy. These layers hinder communication, delay action, and thereby inhibit change and efficient management. The quality that paperwork and procedures attempt to insure is actually degraded by them

Our experience with off-yard availabilities confirms Mr. Damon's account of the effectiveness of project teams. In these cases, participants have direct responsibility and control of quality and performance. This is in contrast to diffused responsibility inherent in the large, functionally organized hierarchy used to manage regular overhauls. When the layers of bureaucracy are stripped away, productivity improves dramatically

Similar programs to the Total Quality Management Program have been and are being attempted at Portsmouth. All have met with some success, if only from learning what does or does not work. None have had any longevity because of the turnover of command. Public shipyards have many advantages over private yards; chief among them is their backlog They provide excellent opportunities to apply new ideas and technologies that ultimately can benefit the private sector. I applaud Pearl Harbor Naval Shipyard for their efforts and thank Mr. Damon for his paper.

Frank Long. Win/Win Strategies

This very interesting, well-organized, and information-filled paper must be read more than once to be fully digested. It describes an ambitious but thoroughly investigated and designed approach to bringing about a significant and pervasive cultural change in the way of conducting business at the Pearl Harbor Naval Shipyard. As stated, the goal is to reduce costs in order to remain competitive. To achieve that goal the yard has adopted a process improvement approach using Dr. W. Edwards Demings 14 Management Principles as a guide and is now in the process of internalizing and institutionalizing those principles.

The Yard is to be commended for having the foresight to engage the services of a qualified external consultant to lead and facilitate the implementation of the process. In addition to the author's reasons in support of the use of a consultant, I would add that the consultant's independence keeps him (or her outside of the political games that are played in every organization. It also allows him to act as the "stinging bee" with anyone at any level who appears to be straying from the charted course or otherwise impeding progress. In my opinion, it is an extremely important role.

The Yard is to be commended also for recognizing that such significant changes in past practices and in management styles cannot happen overnight. We are, after all, creatures of habit, and habits are difficult to break. There need to be constant reminders that the old ways to which people will unthinkingly revert are no longer appropriate New habits need to be substituted and then regularly applied over time if they are to replace the old ways. The Yard's recognition of that fact as well as the fact that this process will take a considerable period of time—three to five years—is another indication of the soundness of its preparation for this campaign.

I would suggest that without the thoroughness of the considerations in support of the implementation of the change, a.. undertaking of this magnitude would have little chance of success. Without so stating, the author realizes that failure of the effort, for whatever reason, would be devasting to any future efforts to address quality problems for years to come.

Panel SP-5's research into similar changes in cultural or managerial styles or both indicates forcefully that if there is one key element in the success or failure of the effort, it is the commitment and involvement of top management:

The last recommendation is by far the most important to the whole process. There must be absolute top management support for the process if it is to succeed. This support must be visible, active and more than mere words. It must be sustained by showing up for problem solving presentations, written in company communications and spoken often in staff meetings. The message must be delivered with consistency. Without this support the effort is doomed [1].[2]

The fact that Pearl Harbor Naval Shipyard and its Commander have completely embraced that philosophy bodes well for the future of the endeavor.

I am also impressed with the Yards' realization of the importance of training and the steps it has taken to address the issue. A note of caution in this matter of training, however:

Although a training matrix and schedule had been developed and agreed upon, production pressures often disrupted the schedule and resulted in employees comple' ly missing their opportunity to train in a particular skill. ... Although production pressures certainly existed, opportunities also existed for training employees on the table. These opportunities were too often neglected and, as a result, the level of multi-skilling and its use on the job did not reach the levels anticipated at the outset of the project. While employees did have the opportunity to practice skills other than their own on the job, these opportunities were more limited than would have been appropriate in order to develop a truly multi-skilled work team [2].

The temptation to respond to production pressures at the expense of training will, at times, be considerable. Management's response to that temptation will send strong signals to those affected. Also, as stated previously, the new way of doing things must be regularly exercised or there will be a reversion to the old habits.

Another caveat which the Yard seems to have recognized but which bears repetition is this: Be especially attentive to the training and involvement of first- and second-line supervision. While they can be important contributors to this significant change effort, some opposition can be expected from them because they are the ones who will be most affected by the changes.

In the Section entitled "The Evolution of Quality," the author refers to certain techniques developed in the 1930's to bring industrial processes into what is referred to as "statistical control." He continues, "Workers could be trained to do this charting themselves thus giving them greater control over their jobs and allowing them to make adjustments on their own." The author's attention is directed to the NSRP Publication entitled "Decentralizing Statistical Accuracy Control Responsibility to the Ship Production Workforce" [3] That Publication describes the three-phase methodology used by National Steel and Shipbuilding Company (NASSCO) to assign statistical accuracy control to the blue collar unionized workforce. The methods included in-process and vital point checking procedures, data collection, and plotting data samples on statistical control charts and histograms. The research done at NASSCO could well be transportable to Pearl Harbor.

On one final point I am less than enthusiastic about the course the Yard has chosen. That is the strategy to get all the managers and supervisors on board before addressing the workforce regarding Quality Circles The author points out that "the relationship between management and the union is seen as adversarial and in need of improvement." It seems to me that this decision acts to further separate the work-

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[2]Numbers in brackets designate References at end of discussion

force and to foster a "We versus They" atmosphere thereby maintaining if not, in fact, deteriorating the adversarial relationship SP-5's experience indicates that the unions and the employees respond positively if they are actively involved in and made a part of the change process. Otherwise all kinds of negative attitudes are allowed to develop while *They* get all training and attention and the rewards of management's efforts and *We* get left out. The fact that "several union officers have attended the training program and have agreed with the direction" tells very little. What was the purpose of training them and what use will be made to their training? The author indicates a recognition of the importance of keeping the union informed regarding process improvement changes that affect the workforce. One way to insure that the communication takes place and is as adequate and as thorough as needs be for the union to effectively communicate with its membership is to involve the union officers in the change process

I would suggest that there is a role for union representation at both the Steering Committee and Process Review Board levels I would also suggest that the Consultant, who is now on-board and will be for a year, could play a major role in facilitating union representation into the decision-making process These suggestions are offered in full recognition that about 85 percent of all problems in an organization are the result of management decisions or errors in the departments that production workers depend on. The creation of an atmosphere where feedback and advice from the worker on the job are sought and accepted before decisions affecting his work are made can have a profound effect on quality and productivity This is the Japanese way. And it is the Japanese whom the author describes as the exemplar in the world for quality and productivity.

In any event. I would look forward, eagerly, to annual follow-ups on this important effort

References

1 *Problem Solving Teams in Shipbuilding*. NSRP Publication. Nov. 1986. p. 17.
2 *Multi-Skilled Self-Managing Work Teams in a Zone-Construction Environment*. NSRP Publication No 0264. Aug 1987. p. 9.
3 *Decentralizing Statistical Accuracy Control Responsibility to the Ship Production Workforce*. NSRP. Jan 1987.

J. B. "Hank" Gerlach, Mare Island Naval Shipyard

The author, for his presentation in particular, and Pearl Harbor, in general, are commended for their entry into a Total Quality Management (TQM) system at their shipyard. Implementation of a shipyardwide quality improvement effort involving the rigid statistical process control concepts of Dr W. Edwards Deming, especially in a largely job-shop environment, is truly a challenge. But, quality improvement in any format is a challenge that shipyards and marine fabrication facilities must face to become or remain competitive.

The paper contains considerable narrative on the "whys" of quality improvement (including a history on "the evolution of quality") and is laced with a potpourri of buzz-word techniques, innovations and initiatives, many inherited from the Japanese and now being used across U.S. business and industry (such as quality circles and other problem-solving efforts), all of which if properly applied are good and will work.

Tom Peters, in a San Francisco presentation he made several years ago, quipped that in writing the book *In Search of Excellence* (co-authored with Bob Waterman, Jr.), he had been accused of simply re-inventing common sense in his portrayal of how to deal with people and problems in the current work society In my opinion then, it is because of this re-birth of common sense, and more than a little nudge

from the Japanese, that we have turned to the Deming, Juran and of more recent vintage the Crosby camps in our realization that poor quality drives up costs, ties up resources, plays havoc with schedules, and is a glaring reflection of poor management.

The paper appropriately defines the importance of the Shipyard Commander (CEO) role and related efforts to invoke full commitment throughout the entire management structure to promote and carry out the plan—a vital point! This sense of ownership and application must be firmly driven down to the first line supervision level. So-called "management commitment" is a proven must for success of any other follow-on steps in a long range plan or process such as this

As the paper begins to describe the "hows" of implementation, there is some degree of ambiguity important to point out which may present an ongoing problem in the future It is stated that "the structure incorporates all the elements to mal : the implementation process work"; then in contrast notes that the "structure evolves and changes continually as it is refined." The paper then acknowledges a workforce perception of fragmentation as the old programs merge with the new elements. I believe the lack of consistency in the plan structure to be a flaw. In this case, the "do it, try it, fix it" approach must be tempered with solid planning and execution because of communication and other problems when dealing with large worker populations such as exists at Pearl Harbor. The consultant will want to deal with this early on

The training (to date) described in the paper again represents a broad mix of quality-related videotapes and off-Yard seminars all directed at management which somehow seems more fragmented than orchestrated to a master plan Worker training appears to reflect job skills training, which is important, but unless properly presented won't get the workforce involved in the cultural aspects of quality improvement. The text implies that the lack of structure in the training process will also be addressed by the consultant.

Another perception is that the types of problems and projects portrayed for study or already being undertaken for study are predominantly production oriented. The Deming comment that management controls 85 percent of quality problems generally means that functions which support production processes cause most of the quality problems For this reason, it is important to bring support personnel into the problem solving process from both technical and administrative areas. (Administrative errors also cause rework and contribute to higher operating costs.)

In conclusion, I believe the Pearl Harbor plan, although as much productivity as quality directed, if provided the proper mix of patience and perseverance over the three- to five-year gestation period suggested will prove fruitful. I look forward to a follow-on paper with more technical information on actual implementation and resulting cost reductions as the plan and the consultant's role evolve.

Author's Closure

Professor Bunch describes four qualities a successful program must have. He notes that the shipyard effort will be successful since it has these ingredients. However, a key change in philosophy must also accompany these ingredients. The old philosophy is exemplified by Mr Damon's statement that "The goal at Pearl Harbor Naval Shipyard [PHNS] is to reduce costs in order to remain competitive " Pearl Harbor must work on improving quality. If PHNS can

improve quality, they will lower costs. This is long-range thinking. The opposite of this is a short-term focus on cutting costs or increasing production or both. This latter path leads to lower quality, higher costs, and decreased market share. In a competitive international market, this posture has proven to be a disaster.

Since coming to Pearl Harbor the consultants have made a serious effort to involve the Union (Hawaii Metal Trades Council [HMTC] as a key structural part of all committees and process review boards. Mr. Long is correct in emphasizing the need to involve the Union as a partner in any quality improvement efforts. The consultants have been well advised by Mr. Long's remarks. It has certainly been recognized that the HMTC must be a part of all quality improvement planning. The Union itself will be encouraged to undertake quality improvement in management of its own processes. This will enable the Union to be better able to serve it's customers and the shipyard.

Several of the discussants were well versed in the Deming philosophy. Mr Maguire's comments on continuous improvement and development of cross-trained middle and upper management illustrates his depth of understanding of Dr Demings principle on "breaking down barriers" (Deming Principle No 9) Mr Maguire correctly noted that for widespread change to occur, cross-departmental efforts must be utilized. At Pearl Harbor these teams are called subcommittees, and their mandate is to identify and recommend strategies for the removal of barriers to all of Deming's 14 principles. The 14 principles of W. E. Deming provide the focus for the new management culture which is evolving at Pearl Harbor. Ms McHenry's statement that "a job order number does not mean the same thing in every shipyard" illustrates the need for clear operational definitions. This is a point Dr Deming and Dr Juran have consistently raised.

Both Mr. Williams and Mr. Peais expressed some disappointment at the lack of discussion concerning the quality circles program at Pearl Harbor. The concept which PMI uses in the development of team efforts is a more focused and management driven approach to work teams. These are called Task Oriented Process Improvement Teams. Time and some research has shown that the Quality Circle (QC) approach was not as effective as it could have been. Basically, this seems to have been due to two reasons: first, because of the lack of integration within the line side of the organization of most such teams; second, because QC's tend to put the responsibility for quality on the worker rather than on management, where it belongs.

Mr. Bongiorni raised the most difficult issue and that is the subject of "constancy of purpose." It is well-known that Rear Admiral (RADM) Traister was recently promoted and as such will be turning over command sometime in 1988. This creates a difficulty in that many people may decide to fence-sit until the direction of the new commander is evident. In other words, they will be thinking "this too shall pass."

A partial solution to this problem rests on several hopes and strategies. The most ideal scenario would be that RADM Traister's next assignment will be in Washington, D.C., as NAVSEA 07, head of all eight naval shipyards. This would allow a broader influence of his commitment to Total Quality Management (TQM) at all naval shipyards. Currently only half of the naval shipyards have initiated such a process.

A second hope rests on RADM Traister's open statement that he will exercise all his influence and authority to ensure that his successor at Pearl Harbor will continue the TQM process. Finally, it is hoped that a critical mass of top management, led by the Champions, will initiate the action necessary to educate RADM Traister's successor as to the importance of the TQM effort. This action could involve

RADM Traister's successor attending a Deming seminar followed by a visit to Pearl Harbor to talk to all managers and committees involved in the TQM process.

The basic strategy for changing the management culture at Pearl Harbor rests on the assumption that an organization is composed of interlocking elements. For a system-wide change to occur, each of these elements must be addressed. Since Pearl Harbor now has a clear vision of the management culture they want to move to, the next step is to establish a structure which can drive the organization towards this vision. Mr. Gerlach pointed out what he saw as an apparent contradiction in the utilization of structure for this objective. Admittedly, this process is somewhat confusing since a large part of the overall process is based on Shewharts PDCA cycle (Plan, Do, Check, and Adjust). In the real world, this seems to be much more effective than linear planning. The assumption that strategy should drive structure is an oversimplification.

Dr. Shumate pointed out several "flaws" in the approach to quality improvement described by Mr. Damon. Among the ones thought to be the most problematical by the Process Management Institute (PMI) consultants were the following: insufficient training for the "internal" SPC consultants; emphasis on "problem-solving" rather than "process improvement"; training employees without an implementation plan for their new skills; and need for integration of ongoing quality improvement efforts.

Each of the above issues noted by Dr. Shumate are currently being addressed in a variety of different ways. The various structures involved in the Shipyard Quality Improvement Process (SQIP) have set up charters and are defining their roles and responsibilities. Statistical process control (SPC) specialists did not take "1 week" of training but had three weeks of training in SPC. Furthermore, their training is being supplemented by the expertise of statisticians from the consulting company. Outside statistical help will continue to be a part of the process until either the in-house SPC consultants are experienced enough to handle the process or until PHNS hires a more experienced statistician.

The in-house SPC consultants are now working on a plan to insure that all SPC training of personnel as "JIT" style. In other words, all efforts will be made to insure that training is given in conjunction with an implementation plan. This will give employees the opportunity to use their new skills on some type of meaningful activity. If this is done, then it is less likely that the new SPC skills taught will go unused and thus quickly be forgotten.

Activities initiated by Process Management Institute. There have been three major activities undertaken by the PMI consultants since the initial description of the project described by Mr. Damon. The major activities addressed by the consultants have been the following: modifications to existing organizational structure, integration of quality activities already underway, and involvement of the Union in the quality improvement process. A brief overview of each of these activities will be described. This will be done to provide some idea of the activities initiated by the consulting company.

Modifications to Organizational Structure—The work of early organizational theorists [4,5] suggested that the structure of an organization should derive from its overall business strategy. Recent opinion [6] is that the problem of management effectiveness is much more circular. The McKinsey 7-S model posits an interlocking relationship between structure, strategy, skills, staff, style, systems, and shared values. Each of these issues is in a sense addressed by Dr. W. E. Deming [7], who has codified them in his 14 principles for management. It is impossible to address the 14 principles

Pearl Harbor Naval Shipyard
SQIP Organizational Chart
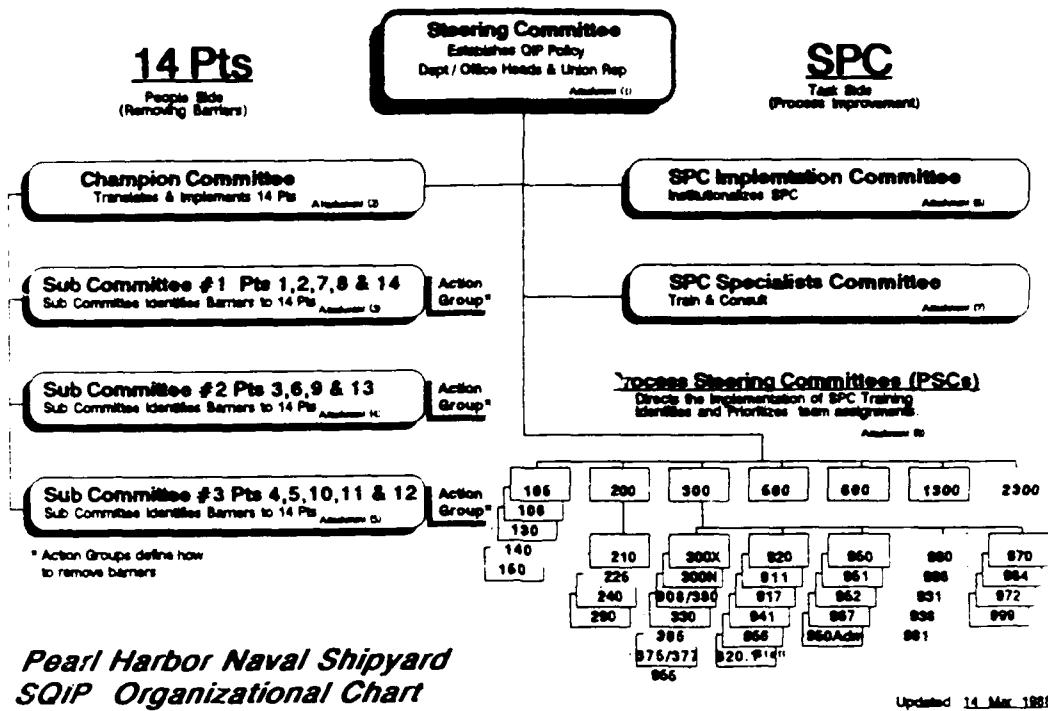
Fig. 1

without making a change in each of McKinsey's seven elements. In practice. however. there cannot be a precise recipe that will fit every organization. Each organization must work towards developing an approach to implementing the 14 principles that fits its own unique circumstances and needs.

At this point in time. the structure established at Pearl Harbor for the quality improvement effort is embryonic and will need to evolve over time. The transformation to a total quality organization will not be complete until every unit and individual in the organization is involved in quality improvement. Dr. Deming points out that 94 percent of the problems in an organization are system problems. Deming includes all units and processes in the organization as part of the system and not only production.

To simplify the process of culture change, the concept of a task and people side (Fig. 1) to the organization was introduced at Pearl Harbor. Blake and Mouton [8] originated this idea but lacked a systematic method for process improvement on the task side or a clear vision of who was responsible for improvement on the people side. In the model at PHNS, hourly and staff employees work in the system and are closest to the process. Thus, it is logical for them to know best how to improve work processes within the system.

With the help of SPC training, hourly and staff employees are the logical people to improve the task side of the organization. Organized on a shop or department level into process improvement teams, workers will address critical tasks that impact the effectiveness of operations at PHNS. The training and consulting at the shop level will be spearheaded by a group of in-house SPC consultants who will have taken 120 hours of SPC training. These individuals were selected from the various shops and departments at the Shipyard.

The in-house SPC consultants will work with their respective units until all Shipyard employees have received training in the seven basic SPC tools. During and after the training phase, the in-house SPC consultants will assist individuals as well as process teams in their units as needed. At the present time, one of the two PMI consultants assigned to the Shipyard is filling the role of statistical trainer and consultant. All employees, teams, and in-house SPC consultants will be guided and given support in their efforts by Process Steering Committees. These committees will be composed of shop and department management and union leadership.

Improving the people side of the organization is an essential part of the quality improvement equation. As W. E. Brock [9]. the Secretary of Labor, recently said. "If workers perceive that managements only interest is on the corporate bottom line—profits and losses—then workers' only interest will be on the workers bottom line—wages and benefits." Sadly, studies do show that in the United States, only 9 out of 100 hourly employees believe that they will receive any benefits from increases in organizational productivity. This figure is 93 out of 100 in Japan [10].

Implicit in the strategy to improve the system at PHNS is the belief that management is responsible for the system. since only management can change the system. Thus. it is logical for them to be assigned the task of improving the system. The strategy to accomplish this involves establishing a top level group of managers (Champions) who each have responsibility for one or more of the Deming principles. They and other key managers attend either a seminar by Dr. Deming or a course sponsored by PMI. The PMI course is an introduction to the Deming philosophy.

The Champions provide direction and support to three subcommittees composed of a cross-sectional and diagonal slice of managers from the organization. It is the responsi-

bility of the subcommittees to identify and develop action plans for removing barriers to each of the 14 principles. The 14 principles provide an overall vision and direction for their efforts. These principles are seen as desirable end states that will never be 100 percent attainable.

With the help of the Champions and with input from others in the organization, the subcommittees will systematically address issues in the organization that impair its overall management effectiveness. The actual implementation of plans will be facilitated by the line side of the organization. Recommendations approved by the Champions and PHNS Steering Committee will be given to the Process Steering Committees headed by key group, shop, and department managers It will be their responsibility to address the actual implementation of plans developed by the subcommittees.

Integration of quality activities. One of the difficulties encountered in many organizations is the prol.eration of disparate and sometimes incompatible quality improvement programs either underway or recently defunct. At PHNS, the QC program has been put on "hold" until all the quali*v improvement training for managers and supervisors has been completed. The centralized QC program (opposed by the union) will be put on hold, and some of the more important concepts involved in quality circles will be continued under the direction of each department or shop's Process Steering Committee. This means that in addition to improvement processes being identified and assigned by committees, employees will also be able to volunteer and work on projects of their own choosing. Of course, project selection must be consistent with overall organizational improvement goals.

Some managers have already started forming Process Steering Committees to work on quality improvement. A proliferation of different approaches could be confusing to employees (as well as to this consultant). Furthermore, it could blur the overall responsibility for quality improvement. To address this problem, an SPC Implementation Committee has recently been established. This committee will be responsible for helping to focus and coordinate the activities of the various Process Steering Committees. The leadership of this committee will report directly to the Shipyard Steering Committee.

The consultants were fortunate in that most of the efforts underway at PHNS could be folded into the quality improvement model developed by PMI. Perhaps even more important was that Rear Admiral Traister and others recognized the need to have a unified effort. The Problem Recurrence Elimination Program (PREP) will now be coordinated by the Process Steering Committees. This returns it to the shops and departments which are closest to both employees and tasks. All former and future quality improvement efforts will be coordinated through the Shipyard Steering Committee. A'l quality improvement efforts will be designated as part of the overall Shipyard Quality Improvement Proce ss or SQIP for short.

With a clear sense of direction provided by the Admiral and the Champions, it is expected that those managers interested in quality improvement will have a banner to rally around. Eventually, all employees and managers will receive training in both SPC and the Deming management philosophy. As this happens, more and more individual quality improvement efforts will pop up. These will add momentum to the efforts being undertaken by both the subcommittees and process improvement teams. Hopefully, the present Beneficial Suggestion System will be replaced by one that can better encourage such efforts.

Union involvement. The Union (Hawaii Metal Trades Council [HMTC]) relationship with management at PHNS was somewhat more adversarial than the consultants had encountered with other clients. From the onset, Union made it clear that they expected a role in the quality improvement effort, but they distrusted managements willingness to provide for such a role. In one rather tempestuous week, the Union sent a message to Rear Admiral Traister that they would not send representatives to the subcommittee meetings, although they previously had agreed to this. The Union decided to withdraw participation since they felt management was acting in bad faith on other issues.

In retrospect, the consultants were not accustomed to the level of distrust between management and the Union at PHNS. Thus, they were rather slow to react to the evident confusion surrounding the Union's role in the process. There was a considerable degree of confusion on both sides surrounding this issue, compounded by the lack of trust. The consultants, caught somewhat flat-footed by a lack of experience with such problems, did not offer much direction

It soon became apparent to the consultants that there was a need to be more productive in :.orking with both sides to resolve the issues. The consultants now meet with Union leadership as needed and at each visit to PHNS. A specific four-hour meeting was arranged between HMTC leadership and the consultant to review the quality improvement process as viewed in the PMI roadmap. Efforts have also been made to ask union leaders outside of Pearl Harbor who are familiar with such efforts to contact HMTC leadership.

As an outcome of the above efforts, the agreed-upon model for the Quality Steering Committees includes union representation on all committees. After some discussion, the HMTC president was also invited to be a member of the Champion committee. HMTC now has representation on the Shipyard Steering Committee, Champion Committee, Subcommittees, and eventually on all department steering committees.

Recently, the consultant invited the Union to work internally on the adoption and implementation of both the 14 principles and SPC within HMTC. If the Union is thought of as one link in the chain of quality at the PHNS, then the chain will only be as strong as its weakest link. In a Total Quality Organization, every unit must work continuously to improve its processes and better serve customers. The consultants see no reason why HMTC should not also be striving for quality. There should be many paybacks to employees, management, and the union from this course of action. Of course, this assumes that the fundamental destinies of all three are inextricably bound together.

Parker [11] states that QWL type programs, "Instead of providing us with more control or influence over our jobs as they sometimes claim, ... are taking away our only real power by undermining our unions" (p. 2). The situation described by Parker does not have to exist. It will exist if management and the Union view quality improvement as a zero-sum game. In this scenario, whatever benefits the Union hurts management, and vice versa. The consultants feel that the exact opposite is true. It is one of the consultant's roles in the process to demonstrate the validity of this proposition to both sides.

Key issues remaining to be addressed. In the opinion of the consultant, it is much too early to determine if the effort underway at PHNS will be successful because there are a number of formidable barriers yet to be overcome. The success of the Shipyard at handling the following ten issues will ultimately determine whether the process is successful

Constancy of Purpose—If the PHNS can continue on the present path even after Rear Admiral Traister leaves PHNS, one of the most apparent and visible obstacles will have been overcome. Nevertheless, every Champion and manager in the Shipyard must demonstrate this principle if the quality improvement effort is to succeed.

Fear—The Shipyard relies too heavily on fear as a motivator. Many managers confuse accountability with blame and assume that the two must go together. The often-spoken-of tendency to "micro-manage" is a direct offshoot of the fear in the shipyard

Time—If PHNS cannot overcome its tendency to micromanage, there will be no time for quality improvement efforts There can be little doubt that it takes more effort initially to improve things that are not broken than to apply the "if it ain't broke, don't fix it" mentality. The only way for a quality improvement effort to succeed is for managers to manage improvement and to delegate the responsibility and authority for actions to the people closest to the work. This is just the opposite of micromanagement, which is another form of waste and re-work.

Sense of accomplishment—The effort at PHNS will take from three to five years to accomplish. Through sustained effort and commitment, individuals will gradually begin to remove roadblocks to the 14 principles of Dr. Deming. This will not be an easy task. Individuals will need to bite off small pieces at a time or risk choking on the whole elephant. In practical terms, a failure to address small manageable issues could lead to a sense of frustration on the part of all participants. Without some visible evidence of improvement, employees are likely to lose their initial enthusiasm for the effort

Definitions, missions, and coordination—Each of the various structures in the SQIP will need to establish a sense of mission. definition, and integration with respect to the organization These tasks must be managed with a win-win attitude. good communication, and a clear sense of priorities. It is essential that guidance and support be given to the managers involved in this effort.

Turnover—It will be difficult to develop constancy of purpose in an organization where the top management is mostly composed of military officers who rotate out every two years or so. What is even more detrimental to the process, however, is the tendency of many top civilian managers to be rotated to other positions during "reorganization" processes. Such reorganizations have abated considerably under the command of RADM Traister, but will need to be even further minimized in the future.

Training—With nearly 7000 employees. PHNS faces a difficult task in training and helping all employees to utilize SPC techniques. Furthermore, it is imperative that all managers, employees, and Union leadership develop some familiarity with the concepts and teachings of Dr. W. Edwards Deming. Employees must have some knowledge of the 14 principles, since ultimately all employees will be involved in the task of identifying and helping to remove barriers to those principles. However, it is important that the emphasis be on quality training and not just on the number of people who are trained.

Individual innovations to the PMI quality improvement model—PHNS will need to take ownership of the quality improvement model developed by PMI. This will be demonstrated by the ability of the Shipyard to adapt and flexibly utilize the model as circumstances dictate. The shipyard must be able to adapt the model to needs that will change over time and to incorporate the model into the ongoing management of the organization.

Union—HMTC can play several roles in the quality improvement process. It can take an adversarial role, a wait-and-see role, or an active participant role. In the participant role, HMTC can insure that bottom-up as well as top-down pressure is exerted on the system to change. The Union might even be able to ensure that substantive changes in the organization become part of the collective bargaining agreement. If this were done, it would be even more difficult for a "change in command" to destroy the continuity of the quality improvement process.

Integration of Deming and SPC—Many organizations see Deming's 14 principles as superfluous to the gains that they hope will come from the application of SPC techniques. Such organizations have a hard lesson to learn. Without a total system-wide change in organizational culture, the benefits to be gained from the application of SPC techniques will not and cannot last. Rear Admiral Traister and other top managers at PHNS have accepted the foregoing premise. Unfortunately, there are still too many managers at the Shipyard who regard the quality improvement process as "just another program." In the opinions of such managers, quality improvement will only require the application of some "fancy" SPC techniques. Life at the Shipyard will then go on as before. A considerable number of these managers will have to be won over before the effort can be successful.

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When Old Solutions Fail: Total Quality Management

James W. Ray

When Old Solutions Fail

Total Quality Management

Brigadier General James W. Ray—US Army Corps of Engineers: Europe Division

We began the total quality management process in Europe because we didn't want to end up like a boiled frog. Let me explain.

The Europe Division of the US Army Corps of Engineers is the US Department of Defense's primary construction agent for Western Europe and Turkey. We serve the Army and the Air Force through construction of operational and support facilities as part of US defense programs overseas. Everything from aircraft runways, to family housing, to post exchanges, service clubs and crafts shops—our mission is to provide the construction to support the soldier and airman in the field as well as his family on base or back in garrison. Our design and construction program has mushroomed in recent years, with a current annual budget approaching one billion dollars. We are involved in planned or on-going work in nine European countries, extending from the North Sea to the Mediterranean.

It is an important and demanding mission, fraught with many challenges. Currency fluctuations in Europe and the impact of the significantly weaker dollar exact their toll as more funds are expended for completed projects initiated when the currency was strong. That along with overall Federal budget deficits and concurrent cuts in military spending have caused US Department of Defense agencies to take a closer look at the way we do business.

Traditionally, we have not had to worry so much about the business side of our operation. Our 21 identified customers have been provided for us; some would even say held captive by us. However, that is changing. New directives point a trend toward greater customer discretion in choosing construction services, even among military commands. For projects costing less than two million dollars—potentially about 80 percent of the business we do—a current proposal would allow local commanders to go to the agency that provides them the most quality product for the price they are able to afford. The ability to obtain the "best build for the buck" potentially places us in the position of having to compete for business we once took for granted.

We want to be the construction agency of choice, not of last resort. And that's where the frog comes in. The story of the frog is a telling analogy for any organization in need of change to meet mounting future challenges.

The frog is an interesting creature, and very adaptable to its normal aquatic environment. He is able to adjust his internal thermostat to match the surrounding water. If you put the frog in a pot of water and turn up the heat, he will simply raise his own blood temperature until he is comfortable. Turn the pot to a boil and the frog does what he has always done. Why not? It has always worked before. Eventually, the frog is the loser—boiled from the inside out.

A simple lesson, to be sure. The message is that organizations which continue to meet new challenges with old solutions are destined to fail, to end up like the frog. The frog may have been doing things right, but in this case he was *dead right*.

Total Quality Management

With Europe Division total quality management (we call it EQM) we intend to be right, but with a higher degree of success and survivability. In fact, we developed the process to "do right things right;" that is, determine what as an organization we should be doing and then set about doing those things correctly. This, with the full understanding that old solutions may no longer work for new problems.

Customer Driven Quality

We reviewed every aspect of our operation. In doing so, we discovered that no matter how good we thought our prod-

ucts and services were, if our customers did not agree with us, we had a major problem. So the founding principle of EQM is based on the customer, and it led us to a new definition of quality as well: quality is achieved when we meet the expectation of our customer 100 percent of the time.

The importance of so simple a concept—providing quality service to the customer—cannot be overstated. For example, the Canadian Management Association studied the reasons customers quit buying. A few stopped because they died or moved away. There isn't much anyone can do about that. Interestingly, though, only 14 percent quit because they were unhappy with the actual product. The fact is, 68 percent quit because of the attitude of indifference by employees of the organization. Almost seven out of ten went somewhere else because they didn't like the service they got—even though the product was fine! Satisfying the customer's expectations was the concept of quality we wanted to pursue and instill in each member of the organization.

Training Challenges

But how to do that with a 1200 member work force so diverse as our own?

With a full one-third of our staff made up of German or third-country nationals the old axiom you've got to speak their language took on new and compelling

> "... we discovered that no matter how good we thought our products and services were, if our customers did not agree with us, we had a major problem."

meaning. To reach our division people, I relied on our division people, and it worked. I sent a small group of 11 of my best, motivated and spirited employees to Minnesota a year ago to attend a program sponsored by 3M Corporation. They underwent training, learned the basic concepts of quality management and brought those principles home with them.

They did more than that. That first group of quality facilitators (there is now a second group and growing) developed a process of their own to teach every member of this organization a new brand of quality, one tailored specifically for the Europe Division of the Army Corps of Engineers. They went to work facilitating the education of every employee in quality management. Then they expanded the curriculum with a few skills they fashioned themselves.

Our employees were taught to identify their customers—not just the obvious ex-

ternal ones, but the customer down the hall or sitting at the next desk. They learned to list the products and services those customers expected. Were we meeting those expectations? That became the essential question, one others have asked of us, but one we may have seldom asked of ourselves.

The EQM phase one is a process of awareness. During a full-day session, it attempts to open the minds of each employee and begin a basic cultural change as to what quality really means. They are asked to focus on more than just the ends, but on themselves as a means toward achieving that product or service. They are asked to personalize the process and understand that every time they deal with a customer it represents a moment of truth for our organization.

To date, more than 1100 Europe Division employees have completed this awareness phase. Each newly arriving employee is trained in the first stage of EQM, even as the second phase has already begun. While the first phase emphasized personal quality, the second focuses on the unit, thus the appellation quality unit improvement process, or QUIP

A QUIP group is defined as two or more employees and a supervisor who produce a product or service. In the initial step of QUIP, a two-day session conducted off-site by a quality consultant teaches the team about basic communication, group development, functional analysis, and problem solving. The next step is actually helping the team to work out specific problems that may be hampering delivery of a quality product or service. Again, the intent is always to improve the ability to understand and meet the customers' expectations.

The supervisor is a part of the QUIP session, but he or she does not lead the group. At one point, without the supervisor present, the QUIP sets priorities on problems that require immediate action.

Continued

Serving the customer is always the focus during EQM meetings. This typical EQM meeting is in a conference room which has been converted into the Quality Institute.

Finally—and this is the key—the QUIP decides together, and accepts together, the best solutions to the problem as they seem them.

QUIP is the practical side of the total quality management theory. It is a long process, and there are some 300 separate QUIP groups in the Europe Division.

There are no illusions when it comes to total quality management. Change, meaningful change, does not come easily and quality, as a way of life involves a cultural adjustment that takes years to absorb. Yet, many of the process's critical elements, only concepts a year ago, are totally institutionalized today. Along the way a thousand people have accepted the notion that our customers deserve the quality products and services we are capable of providing.

Results

So, is it working? I guess that's the bottom-line question of any process. It is still early to assess the impact, the return from the EQM investment. However, the trends look good. The first quarter of this year, our sick leave rate declined 30 percent. I could cite a few awards we have garnered and other successes that I feel are directly or indirectly attributable to the EQM process. However, that one statistic—fewer lost sick days—is most telling. When we began the process I said that I would know EQM is succeeding when every person in the Division enjoys coming to work and truly believes that he or she plays an important part in the overall management of the organization. That day may not be here yet, but it is fast approaching and EQM is paving the way.

EQM is not a program, and I never refer to it as such. Programs have beginnings and ends. EQM is continuous and fast becoming a way of life. When it does, our Europe Division will be a total quality organization, one that is responsive and committed to the customer and meeting the important expectations involved in critical matters of defense and security of nations. That is our goal, and EQM is helping us to achieve it. ☐

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*Implementing Gain Sharing in a Total Quality
Management Environment*

Col. J. B. Gartman and John S. Fargher, Jr.
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IMPLEMENTING GAIN SHARING IN A TOTAL QUALITY MANAGEMENT ENVIRONMENT

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INTRODUCTION

The Naval Aviation Depot (NAVAVNDEPOT) at Cherry Point, North Carolina has embarked on total emersion into Total Quality Management (TQM). Significant progress has been made in the implementation of TQM. Process analyses have been accomplished utilizing Process Action Teams (PATs). A complete TQM structure has been developed, Statistical Process Control (SPC)/TQM-trained personnel are available, and employee participation in the TQM process has been accelerated. Productivity Gain Sharing (PGS) has also been initiated facility-wide, a first within the Department of Defense, to share the financial benefits of working harder and smarter. Because of the progress made towards implementing a complete philosophy of productivity and quality improvement in its work force, NAVAVNDEPOT Cherry Point is being recognized by the prestigious IIE Award for Excellence in Productivity Improvement for 1988 in the manufacturing sector.

PGS is an employee involvement system designed to motivate employees to improve the productivity of their work group through better use of labor, material, etc. In addition, gain sharing provides a means of measuring specific areas of productivity and offers a mutual stake in the sharing of any increase to total organizational productivity with all those responsible for the increases. The PGS Program is intended to encourage process improvement (working smarter). It is anticipated most significant gains will be made in process improvement utilizing the TQM organization. A NAVAVNDEPOT Cherry Point PGS plan has been written with the intent of providing an appropriate award system/payout mechanism for these TQM efforts.

The plan is a SHRED COST model with baseline data developed based on the average NAVAVNDEPOT cost performance for each product for each of the previous quarters. Productivity gains are paid for each quarter that the facility exceeds this average. The baseline is also updated at the end of the fiscal year with new quarterly data. PGS awards are paid upon increased productivity (i.e., decreased auditable costs). Payout is also based on meeting acceptable quality levels, defined as maintaining statistical process control of the quality index, and acceptable schedule production using a schedule index. An equal sharing (50 percent/50 percent) of savings between the activity and employees is based upon productivity increases

in the baseline. The full model is described in the paper, including measurement techniques. The paper also describes the NAVAVNDEPOT's experience using PGS with lessons learned during implementation.

Background/History of the DoD Productivity Gain Sharing Program

The President of the United States issued Executive Order 12552 on 26 February 1986 which established a comprehensive program for productivity improvement throughout the Executive Branch, requiring a 20 percent productivity increase (or 3 percent per year) by 1992. Interpreted by Office of Management & Budget (OMB) Bulletin 86-8, issued 3 days after the Executive Order, each agency was directed to develop a productivity improvement plan. The OMB bulletin, although focusing on smaller demonstration or pilot projects, emphasized measurement, performance standards, employee involvement, technological enhancements, organizational stream lining, methods/process improvements, and human resource improvement/utilization. In a 14 November 1986 OMB memorandum to the members of the President's Council on Management Improvement, the concept of productivity gain sharing was endorsed by the director of OMB based upon demonstrated success in DoD's gain sharing efforts. OMB Bulletin 87-12, dated 14 May 1987, provided further guidelines for the development and implementation of agency productivity improvement plans in accordance with Executive Order 12552, especially in establishing the roles of various agencies and the requirement for reporting of agency productivity improvement plans to OMB. The OMB announced on 2 March 1988 selection of NAVAVNDEPOT Cherry Point as a Productivity/Quality improvement prototype in the Federal Productivity Improvement Program. Representative of the performance improvement efforts throughout the Naval Aviation Depot community, OMB's selection recognized Cherry Point as the lead activity in a variety of productivity/quality improvements. Prototype activity designations recognize early successes, motivate and provide models for productivity/quality improvement in other agencies, and provide visibility for high achievers. OMB's selections are based on management attention, achieved performance, and commitment to productivity/quality improvement throughout the organization. The principal areas of improvement at Cherry Point noted by OMB are lower labor rates, improved business systems, technology advancements, and

timely service to the fleet. Much of the improvement made to date, according to OMB reviewers, is associated with streamlining operations resulting in the depot becoming more efficient and effective. A 73 percent productivity improvement in the Grind-Plate-Grind process, 90 percent reduction in aircraft engine test failure rates, and 80 percent reduction in inspection rejects of helicopter rotor hub repairs are just a few examples of the improvements recorded.

The Department of Defense has been a leader in the area of planning and development of initiatives for productivity improvements. Established in 1966 to improve logistics operations, the Defense Productivity Program Office has broadened its responsibilities into all areas of productivity improvement within the DoD. First issued in 1975, DoD Directive 5010.31 (DoD Productivity Program) is the cornerstone for the DoD efforts. DoD Directive 5010.37 (Efficiency Review and Resource Requirements Determination), DoD Instruction 5010.34 (Productivity Enhancement, Measurement and Evaluation - Operating Guidelines and Reporting Instructions), and DoD Directive 5010.39 (Work force Motivation) are sister directives. DoD Instruction 5010.39 states, as policy, to "support the application of motivation techniques that will improve job satisfaction and the quality of work life and increase productivity of the work force." Various PGS programs have been initiated within the Department of Defense with limited application. Specific programs have included such functions as shown in Table 1 (taken from DoD Guide 5010.31G). These limited efforts as well as research begun in 1981 indicated that supervisors and managers within DoD felt that employees need to be rewarded for performance beyond that provided by the salary system and incentive awards. This research effort included a survey of the relevant literature and personal interviews of private sector and state and local government personnel involved in incentive programs. The GAO, in a report issued in 1981 entitled "Productivity Sharing Programs: Can They Contribute to Productivity Improvement?" (GAO Report AFMD-81-22 of 3 March 1981), supported the use of PGS to improve productivity. The programs listed in Table 1 were initiated to satisfy a need for specific productivity improvements as well as for research. DoD Guide 5010.31G, "Guide for the Design and Implementation of Productivity Gain Sharing Programs," developed by the Director, Defense Productivity Program Office and issued by the Office of the Assistant Secretary of Defense (Manpower, Installations and Logistics) dated March 1985, describes current DoD PGS programs and

TABLE 1 - DOD PGS PLANS

Service	Application	Location	Remarks
Navy	Key entry	Mare Island NSY Norfolk NSY Philadelphia NSY PWC San Diego Long Beach NSY North Island NAVAVNDEPOT	Individual performance contingent reward system only for key entry operations.
	Boiler repair	Philadelphia NSY	Gainsharing group plan using performance factor derived from group efforts but payout based upon individual hours expended. 50/50 split paid next pay period.
	Vehicle repair	PWC San Diego	Individual performance contingent reward system direct workers only. 30/70 split paid every 2 weeks.
	Small purchase order from processing	Pearl Harbor NSY	Individual performance contingent reward system based upon small purchase order from processing for small purchase buyers and clerks.
	Aircraft engine overhaul	Alameda NAVAVNDEPOT North Island NAVAVNDEPOT	Individual performance contingent reward system involving direct workers only. Alameda's plan included buyback and 50/50 split. (Never implemented)
	Inside machine shop (31)	Mare Island NSY Pearl Island NSY	Group incentives system with performance factor derived from group incentives but payout based upon individual hours expended.
Army	Maintenance Maintenance Maintenance/Procurement Supply/Inventory Mgmt Transportation/Supply Supply	Anniston Army Depot Red River Army Depot Sacramento Army Depot Tobyhanna Army Depot New Cumberland Army Depot Sharpe Army Depot	50/50 split for each work center where the Production Efficiency exceeds 100%. Payment is based upon hours gained over 100% PE times the direct basic labor rate with a quarterly or monthly (Anniston, Red River, New Cumberland) or monthly (Sacramento, Tobyhanna, Sharpe)
	Key entry	Redstone Arsenal	50/50 split with profit determined from historical data of number of records processed. Payment at the end of the test with payout as follows: 60% of employees share to personnel who exceed an average of 238 records per hour; 20% to personnel exceeding grade production standards; and 20% to supervisory and lead personnel.
	Pay examiners	Army Research and Development Command (ARDC) Office of the Comptroller	50/50 split with profit determined by beating the standard and indirect man-hour allowance. Monthly payout.
Air Force	Key entry	McClellan AFB	Same as Navy's key entry.

"lessons learned" from PGS plans from earlier research. Authority for PGS programs is given in Chapter 45 of Title 5 of the U.S. Code for Incentive Awards [5USC 4503]. A later report by GAO entitled "Gain Sharing - DoD Efforts Highlight an Effective Tool for Enhancing Federal Productivity" (GAO Report GGD-86-143BR of 26 September 1986) highlighted DoD successes. In a 26 March 1986 joint agreement signed by the Secretary of Defense, Deputy Secretary of Defense, Secretaries of the Military Departments, the Chairman of the Joint Chiefs of Staff, and the Chiefs of Staff of each of the four services, productivity goals were established with two basic goals and ten objectives for an aggressive productivity awareness and improvement process.

The Navy, through an active participation in early PGS programs, recognized the requirement to establish productivity improvement policy, guidelines, and requirements. The Navy's Incentive Award Program, provided in Civilian Personnel Instruction (CPI) 451, Appendix F, addresses Productivity Improvement Award Plans (PIAPs). These plans relate to gain sharing. Instructions approved by the Secretary of the Navy on PGS as a means to incentivize employee involvement and participation in productivity improvement efforts, resulting in proven productivity savings, culminated with a 4 January 1988 policy on PGS. This instruction, NAVSECINST 5200.36, recognized PGS as "most successful when applied activity-wide on a long-term basis as part of a total performance/productivity improvement plan." Teamwork, employee involvement, incentivized performance, and individual and group "better ideas" and innovations are stressed by this instruction as part of a successful productivity improvement program. Maximum flexibility is authorized within existing regulations to design, implement, and administer PGS plans. The instruction goes on to state that the PGS plans are to be in addition to current individual employee performance and incentive awards programs such as beneficial suggestion and merit pay awards. Additional funds are not authorized for PGS, these funds being made available from real savings in appropriated operations and maintenance or industrial funds. The PGS payout must be based on the approved budget and must be auditable and certified.

The Naval Air Systems Command, long a supporter of several PGS initiatives in the Naval Aviation Depots, formed a PGS ad hoc Study Team in April 1987 under the Deputy Commander to implement gain sharing in the command. Even before this the Naval Aviation Depot Operations Center (NAVAVNDEPOTOPSCEN) and NAVAVNDEPOTs were exploring PGS as an initiative under the Naval Industrial Improvement Program (NIIP) and as a way to extend the new focus on TQM. A PGS Assessment Team was formed in November 1986 at the direction of the NAVAVNDEPOTOPSCEN/NAVAVNDEPOT Depot Executive Council for the purpose of evaluating the pros and cons of various programs, reviewing current policy and procedures for establishing and administering a PGS program within the NAVAVNDEPOTs, eliminating barriers to successful implementation, and making recommendations for improving current policy and

procedures. The result of this assessment team was a generic PGS plan. The PGS Assessment Team was made up of representatives from the NAVAVNDEPOTOPSCEN and each NAVAVNDEPOT.

Productivity Improvement Initiatives Under Way at NAVAVNDEPOT Cherry Point

Productivity improvement doesn't just happen; it must be planned and implemented with a cohesive, comprehensive philosophy. Top management must commit to productivity gains through planning and management action such as provided for in strategic/business planning. The philosophy of continual productivity and quality improvement by the analytical methods of SPC as done in TQM is central. Evaluation in the achievement of strategic goals and objectives and analysis of process parameters is necessary to measure progress. These three separate and distinct, yet cohesive techniques are described in detail in a paper entitled, "An Integrated, Proactive Approach to Planning and Measurement of Quality and Productivity - The Naval Air Rework Facility, Cherry Point, N. C. Case Study," done for the American Production and Inventory Society (APICS). An update of this case study entitled, "Updating the Plan for Quality and Productivity Improvement," was presented at the 1987 IIE Integrated Systems Conference. Combined with an accounting system that accurately measures costs incurred to produce each product, as described in a paper entitled, "Managing to Actual Costs," presented at the World Productivity Forum and 1987 International Industrial Engineering Conference, and other programs, such as Value Engineering (VE), beneficial suggestion, and source breakout for lower material costs, continuous improvement in productivity and quality is assured as long as management attention to detail and employee involvement is maintained.

PGS is a means to motivate artisans and managers alike to focus on working harder and smarter. Along with increased physical effort, managers and artisans alike must work together to fully implement the strategic plan, use SPC/TQM as a tool for continuous process improvement, and measure results in increased quality and productivity and reduced costs.

Planning PGS Implementation at NAVAVNDEPOT Cherry Point

To introduce PGS to NAVAVNDEPOT Cherry Point, the Commanding Officer requested and received approval for a $20 payout in December 1986. The request was based upon achieving a first place rating in the Management Effectiveness and Performance Evaluation (MEPE) each quarter for the preceding five years as measured against the other five NAVAVNDEPOTs and for winning Naval Material Command Productivity Excellence Awards (FYs 82, 83, and 84) and Naval Material Command Management Effectiveness Awards (CYs 83 and 84).

The first meeting of the NAVAVNDEPOT PGS Committee was opened at 0800 on 6 January 1987 by the Commanding Officer who gave a brief summation of

what gain sharing is and potential benefits to be derived for the depot in productivity increases, cost reductions, improvement in quality, and employee awards. The Production Department Head is the individual responsible to the Commanding Officer for PGS program establishment and implementation; however, the chairman of the PGS committee is the branch supervisor of the Machines Branch, Metals & Process Division, Production Department. Representatives include non-supervisory personnel from several departments and vice-presidents of the two largest lodges of the principal labor unions within the depot (IAM&AW 2297 and IAM&AW 1859). The initial efforts of committee members was that of learning about PGS from DoD 5010.31G, "Department of Defense Guide for the Design and Implementation of Productivity Gain Sharing Programs," and two case studies from industry. The chairperson and various committee members attended PGS training at the U.S. Army Management Engineering Training Agency (AMETA) and Bowling Green State University Productivity and Gain Sharing Institute in Perrysburg, Ohio.

The team began by linking the TQM philosophy and PGS. A measurement model was developed by two of the team members as a strawman and modified by the committee. Using real data as a baseline, the model, described later in this paper, was run for evaluation purposes. The committee was then broken up into separate subgroups to (1) develop and define project objectives and requirements, (2) develop productivity measurement guidelines (model), (3) determine the "group" of participants, (4) recommend training, (5) recommend intervals and amount of payout share, and (6) develop the linkage between PGS and TQM. The committee reassembled to review, modify as appropriate, and approve subgroup recommendations. A new format for the model was developed, all employees regardless of pay were included in the PGS plan, and training was identified. A quarterly payout was also decided upon along with a 50/50 share split. Other issues addressed included including military personnel (a waiver is required as it is presently against the regulations), development of quality and schedule indices as part of the measurement model (approved, using base period statistics), reserve pool requirements, assessing cost and streamlining the process of issuing checks, method of presenting the checks, and exclusion for marginal performance (disapproved as not relevant; discussed later in lessons learned).

The model received the approval of NAVAVNDEPOTOPSCEN on 2 March 1987, but still required approval by outside sources. The full PGS plan was thus begun in March 1987 to describe the program in detail and to secure approval. Providing a forum for the Department of Navy Productivity Plan, a Department of Navy High Performance Action Team (HIPAT) meeting held on 17 March 1987 centered on the objectives of PGS, impediments to PGS, and the need to move from small group to organization-wide programs. Although the Naval Sea Systems Command had been designated as the lead activity for PGS, it was evident that the draft model proposed by the NAVAVNDEPOT Cherry Point PGS Committee was already developed with the

ability to achieve post-implementation audit to confirm savings and included employee and labor union involvement, establishing the NAVAVNDEPOT Cherry Point plan considerably ahead of schedule to the Naval Sea Systems Command model and plan.

In a memorandum on PGS assistance on 3 June 1987, the Specification Control Advocate General of the Navy designated NAVAVNDEPOT Cherry Point along with 11 other facilities as designed activities for implementation of PGS. The Navy Personnel Research and Development Center (NPRDC) was assigned to assist NAVAVNDEPOT Cherry Point with a pre-implementation assessment of actions required, verify the approach, and recommend complementary actions which could enhance chances for success. To assist in this assessment, NAVAVNDEPOT Cherry Point developed an employee opinion survey to ascertain employee awareness of PGS and TQM.

An official copy of the NAVAVNDEPOT Cherry Point PGS plan was forwarded to the Naval Air Systems Command in mid-June 1987 for approval. Approval was finally received from the Assistant Secretary of the Navy (Shipbuilding and Logistics) and the Commander, Naval Air Systems Command just in time for first quarter FY 88 implementation.

Besides help from NPRDC, NAVAVNDEPOT Cherry Point was assisted by the American Productivity Center and many recommendations by the Office of the Secretary of the Navy, Office of Civilian Personnel Management, Navy Comptroller (NAVCOMPT), Naval Air Systems Command, and Naval Aviation Depot Operations Center.

Measuring Financial Results

As the complete PGS plan was developed, top management at the depot continued to be briefed and comments/recommendations considered for incorporation into the plan. One such issue was Net Operating Results (NOR) that later became a big selling point for the plan. NOR is the profit or loss that the facility achieves based upon operating as a business. Under the philosophy of the Navy Industrial Fund (NIF), the depot is to operate at "break even" with the goal of no losses or gains. The rates charged by the depot are set to reflect that philosophy. Throughout the year there are changes in the work content and purchased parts required to repair and overhaul an aircraft, engine, or aeronautical component that will result in gains and losses that are within statistical control, and workload mix may also shift to require the depot to produce higher or lower cost items, these changes obviously affecting NOR. If real productivity gains are to be made, however, these gains should be reflected in NOR gains. Outside influences, such as budget decisions, also affect NOR by artificially reducing rates because of the non-availability of customer funds or elevating rates to cover previous years' losses. The point of all this is that given "break even" rates based upon historical cost data should produce a surplus of NOR as the work is billed out if real productivity gains are achieved. A requirement of the PGS plan was thus developed that payout will be from the depot's NOR at the end of the quarter

being measured and the depot must have a positive NOR equal to or greater than the PGS payout or the payout would be limited to the NOR achieved. In fact, the first quarter FY 88 PGS payout was limited by NOR as shown in Table 3.

Measurement of Schedule and Quality

Although cost is the determinant in determining payout, schedule and quality must not suffer, otherwise the fleet is not well served and the objectives of TQM will not be satisfied. Therefore, a PGS award may be eliminated if schedule and quality indices are not met. Acceptable schedule production is measured by using schedule indexes established for the number of units produced in the aircraft and engine programs and the number of man-hours scheduled versus the number of man-hours completed in the component program. The indexes are defined as an acceptable percentage of units/man-hours produced versus the number scheduled. These indexes indicate the minimum acceptable production schedule performance percentage used for PGS Awards. Payouts will not occur if these scheduled performance percentages are not met except when deviations are authorized by the Commanding Officer. If units/man-hours produced, compared to the index, fail to meet the acceptable schedule performance percentage, the gain sharing coordinator shall initiate an investigation. If the investigation determines the schedule performance percentage or percentages were exceeded because of external influences, the coordinator shall inform the Commanding Officer. The Commanding Officer must grant a waiver before a gain sharing award payout can occur. The following acceptable production schedule performance percentages use the same baseline period established for productivity:

Unit Schedule Index:
  95 percent Minimum Schedule Performance Percentage (Aircraft)
  97 percent Minimum Schedule Performance Percentage (Engine)

$$\frac{\text{Units Produced}}{\text{Units Scheduled}} = \text{Scheduled Performance Percentage}$$

Component Program Computation Formula:
  97 percent Minimum Schedule Performance Percentage.

$$\frac{\text{Man-hours Completed}}{\text{Man-hours Scheduled}} = \text{Scheduled Performance Percentage}$$

Final calculations are rounded up to next whole percentage

Acceptable quality levels are defined utilizing a Quality Index previously established by the Quality and Reliability Assurance (Q&RA) Department. A chart of the Quality Index is illustrated in Figure 1. An acceptable quality level, for the purpose of this plan, is defined as maintaining SPC of the Quality Index. The Quality Index is considered within SPC if the quarterly Quality Index is within a lower control limit of three standard deviation computed from the mean. The mean shall be computed

utilizing the same baseline period established for productivity. Exceeding the lower control limit will result in denial of the PGS Award <u>unless</u> factors external to the Naval Aviation Depot Cherry Point cause the deviation. If it is determined that the external factors were out of Naval Aviation Depot Cherry Point control, then the Commanding Officer may waiver the denial and grant the awards.

DEPOT QUALITY INDEX
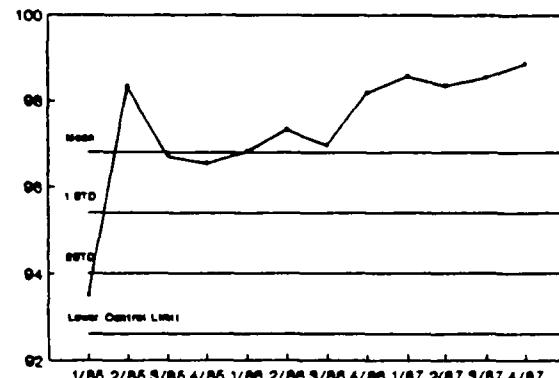
Figure 1

Employee Eligibility

All employees on the payroll on the last day of the last full pay period of a quarter will be considered eligible for PGS Awards with one exception; employees not in a duty status at least 320 hours during the quarter. Employees will be considered, for purpose of this plan, in a non-duty status when placed in any of the following pay or non-pay categories: annual leave, sick leave, court leave, military leave, administrative leave, leave without pay, absent without leave, and traumatic leave.

Calculation of the PGS Payout

For the test period (FY 88), the baseline data is the average NAVAVNDEPOT performance for each of the quarters in FY 85 and FY 86. If the program is extended beyond FY 88, the baseline will be recomputed by adding FY 87 and FY 88 and adding at the beginning of each fiscal year the immediate past fiscal year performance data to all previous baseline quarters' performance for a new average. Productivity gains are to be recognized for each quarter during the program that the depot exceeds average baseline quarterly productivity. The equations for calculating labor savings is as follows:

Earned Hours:
Direct Labor Expended x Performance Factor

Productivity Index:
Earned Hours/Total Hours (Direct & Indirect)

Allowed Hours:
Earned Hours/Base Productivity Index

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Saved Hours:
Allowed Hours - Total Hours

Labor Savings:
Saved Hours x Average Salary per Hour

The equations for calculating direct material costs are as follows:

Each Type/Model/Series in Each Subprogram

Unit Material Savings (Loss):
Baseline Cost Each - Current Cost Each
Material Savings (Loss) Each x # of Units

Total Savings:
Sum of Unit Savings (Loss)

Indirect material savings are calculated as shown below:

Usage Rate Base and Current:
Earned Hours/Material Cost

Percent Improvement:
Current Rate/Base Rate

Indirect Material Savings:
Current Material Cost x percent improvement

Simple steps for calculation of savings in the aircraft program material expenditures workload in the PGS calculation are shown in Table 2. Table 3 is the calculations for PGS for 1st Quarter FY 88 that resulted in a payout of $265.14 per employee. As can be seen from the calculations, the monetary gains are shared equally between the depot and the employees (50/50 split). Each eligible employee receives an equal share by a separate check each quarter. Ten percent of the employees' share is held in a reserve pool to be fully distributed at the end of the 4th Quarter combined with the 4th Quarter awards to all employees eligible for the 4th Quarter payout. Those funds not paid because of lack of NOR or not meeting schedule or quality indices will revert to the NAVAVNDEPOT. An award payout will only be made for a quarter if the individual payout exceeds $25; otherwise, the payment will be held until the payout exceeds $25.

It is recognized that, in the face of extraordinary budget reductions, this PGS Program will be reassessed and possibly suspended for the duration of the crisis. This decision will rest with the Commanding Officer. Awards will not occur during the suspension period nor will retroactive awards be granted on resumption of the program for completed quarters during the suspension period. The performance data for all quarters completed during the suspension period will be computed and added to the baseline.

The measurement criteria formula contained in Tables 2 and 3 has been subjected to sensitivity analysis by testing previous quarters' data as well as substituting hypothetical values for various data elements of the formula to determine the effect. The model reacted in both cases as expected and in the proper manner.

Employees may also receive awards for individual performance such as: beneficial suggestion awards, sustained superior performance awards, quality step increases, special act or service awards, and Buy Our Spares Smart (BOSS) awards. The combined value of the beneficial suggestion awards to depot employees is, however, subtracted from the total savings to obtain the gross gain sharing pool. This is done as employees cannot be paid twice for the same act. The cost savings generated from the beneficial suggestion, to the extent it reduces cost within the depot, does, however, influence depot productivity and will add to the PGS payout to the extent it exceeds the beneficial suggestion award payout.

Table 2
AIRCRAFT PROGRAM MATERIAL EXPENDITURES
(Financial Completions)

TMS	UNIT COST BASELINE	UNIT COST CURRENT	MATERIAL SAVINGS(LOSS)	UNITS PRODUCED	TOTAL SAVINGS
CH46E SDLM	$ 31,453	$ 25,088	$ 6,365	3	$ 19,095
CH46D SDLM	24,875	19,122	5,753	1	5,753
CH46E (SRMH)	91,506	92,126	(620)	13	(8,060)
OV10A SDLM	33,379	33,870	(491)	1	(491)
P4S SDLM	103,243	119,477	(16,234)	3	(48,702)
WF4B SDLM/MOD	114,701	101,075	13,626	3	40,878
CF4N SDLM/CONV	0	56,887	0	1	0
UH46A SDLM	0	26,754	0	1	0
RC13XF SDLM	0	84,714	0	2	0

Total Material Savings(Loss) Aircraft Program = $ 8,473

PGS Audit Requirements

Program effectiveness evaluations are to be conducted on a random, unannounced basis by a team appointed by the Commanding Officer. The evaluations shall be accomplished not less often than annually. A written report is to be rendered on the positive and negative aspects of the current program. The evaluations are also to detect any data manipulation that might prejudice the measurement criteria. Disciplinary action for fraud will be taken against any individual who deliberately manipulates or falsifies data if such action prejudices the PGS results, to include awards not legally earned under the plan. An independent internal review was completed on 14 March 1988, validating the PGS payout accuracy.

It is also expected that audits will also be conducted by external audit services. It is the intent of the PGS program to maintain the program that results in favorable audit findings.

PGS Training

PGS training has been provided to all employees in conjunction with TQM training. General discussion of key provisions of the test plan have been presented to NAVAVNDEPOT employees through our existing established employee communication channels. In addition, articles in the NADEP NEWS,

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Table 3
PRODUCTIVITY GAINSHARING MEASUREMENT FORMULA

Performance Period: 1ST QTR 98

Labor Productivity Measurement	DEPOT Baseline	DEPOT Current	AIRCRAFT Baseline	AIRCRAFT Current	ENGINES Baseline	ENGINES Current	COMPONENTS Baseline	COMPONENTS Current	OTHER SUPP/MFG Baseline	OTHER SUPP/MFG Current
1. Direct Labor Man-hours Expended			290135	228981	81004	64357	237269	164453	180812	221998
2. Times Performance Factor			0.7416	0.8489	0.8046	0.8986	0.8699	0.8799	0.8643	0.8732
3. Equals Earned Hours	643704	590800	215209	194382	65019	57867	206400	144702	156276	193849
4. Divided by Total Man-hours (D+I)	1525324	1273231								
5. Equals Productivity	0.4220	0.4640								
6. Allowed Hours (CUR #3 / BASE #5)		1400000								
7. Saved Hours (CUR #6 - CUR #4)		126769								
8. $ Savings (#7 X $12.66 Avg Pay/Hr)		$1,604,896								
9. Percent Improvement (#7 / #4 CUR)		9.96%								

Material Savings:
1. Aircraft Program Material Savings (Loss)		($579,049)
2. Engine Program Material Savings (Loss)		(430,867)
3. Indirect Material Savings (Loss)		795,523
4. Total Material $ Savings		295,607

TOTAL SAVINGS (Labor + Material) $1,890,503

GAINSHARING DISTRIBUTION

			RESERVE POOL	ADJUSTMENTS	TOTAL
1. Total Savings (Loss)		$1,890,503	1ST QTR $86,317	$530	$86,847
2. Minus Beneficial Suggestion Awards Payout		8434	2ND QTR		
3. Equals Gross Gainsharing Pool		1882069	3RD QTR		
4. Times 50% Equals Employee Share		863169	NOTE: Employee share		
5. Minus 10% Reserve Pool		86317	was capped by Net		
6. Equals Employee Share to be Distributed		776852	Operating Results (NOR)	TOTAL $86,317	$530	$86,847
7. Divided by # of Eligible Employees		2930	Otherwise payout would have		
8. Equals Individual Share		$265.14	been $289.05 vice $265.14		

Schedule Index

			ACTUAL AMOUNT PAID OUT	
a. Aircraft	95%	100%		
b. Engines	97%	101%	1ST QTR $776,329.92	
c. Components	97%	101%	2ND QTR	
			3RD QTR	
Quality Index	92.62 to 100.00	98.37	4TH QTR	

Net Operating Results (YTD) $863,169   TOTAL $776,329.92

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the NAVAVNDEPOT Cherry Point newsletter, have discussed PGS.

Lessons Learned

Before TQM and PGS, concentration by management and the artisans was directed at meeting schedule. Being the most measurable of production criteria, schedule was all important. Artisans felt that if management couldn't see the problems at the depot, well, that was management's problem, not theirs. The artisan could become a hero by working around the system (i.e., finding just the right part under his bench to produce an item after everyone had milled around wasting time looking for that part).

Once the linkage between TQM and PGS was understood by the artisans from the simple equation, Productivity = Output/Input, they have become concerned not only with output (i.e., schedule), but also input (labor, material, support labor, and other costs). Changes are required and are being made in managers' management style, from authoritarian to participative. Now the hero is the artisan and/or manager who, as part of a Process Action Team (PAT), suggests ideas to improve the processes, resulting in higher yields, less waste, higher quality, improved productivity, and incidentally, a higher PGS payout. Artisans are making better use of automated information tools. More hotline calls are being received - workers concerned with waste and inefficiency. Managers are being stopped in the hall by workers relating problems that the artisans expect to be solved. Better teamwork is being observed between the artisans and support personnel, especially through the PAT process. Managers are working much

harder as they are required to solve process problems with many more inputs. Gain sharing is driving the use of SPC as the control over processes, even in this job shop environment.

The $20 gain sharing payout in December 1986 did spur on the interest in gain sharing; however, employees were still skeptical. They began to see the value of TQM, but not really any payback. The 1st Quarter FY 88 check for $265.14 (minus taxes) has really energized everyone.

The issue of paying the full PGS share to a marginal or unsatisfactory employee is a complex one. PGS is a group versus an individual award. In addition, marginal or unsatisfactory performance is a disciplinary issue necessitating management action to require performance to improve or for the employee to be dismissed. Additionally, performance appraisals are subject to appeal and reversal if the appraisal is found unwarranted. While the PGS payout may "reward" an undeserving employee, the PGS committee felt that the problems and perceptions associated with not paying marginal and unsatisfactory performers were outweighed by the impact of total group performance and that poor performance should be handled with separation so that habitual poor performers would not be around for the next payout.

For PGS to be fully successful and to remain a viable program, it must be tied to overall quality and productivity improvement such as offered by the Navy's Total Quality Management (TQM) philosophy. Other criteria, taken from Appendix F of the Navy's CPI 451, should also be met as follows (liberal interpretation taken):

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o   PGS plans must be developed by in-house
    professionals who are trained in the analysis
    and interpretation of productivity data,
o   Membership in the PGS committee should include
    union representation,
o   Work must be able to be measured objectively in
    terms of work packages, schedules, and work
    content,
o   Valid performance standards must be available,
o   Work performance must be directly tied to
    individual and group performance with the pace
    of work representing individual effort,
o   Work is of a recurring basis so that a baseline
    can be established,
o   Payment must be sufficiently significant and
    timely to motivate the group,
o   The group must be sufficiently self-sufficient
    to not be tied to the performance of others,
    and
o   Continuous and visible top management support
    is essential and must include a focus on
    improved quality, increased productivity, and
    more participative management.

There are threats to PGS that, if encountered, may
preclude payments. These include:

o   Adequate workloads to absorb productivity
    increases or at least allowing attrition,
    rather than formal reduction in force (RIF) to
    take place. (Even with attrition, skills mix
    may become a barrier to productivity as cross-
    training does not maintain continuous
    productivity improvements in the short run.),
o   Availability of parts and material to
    accomplish the work, and
o   Stable economic environment ("break-even" rates
    allowed by NAVCOMPT, sufficient manage to
    payroll authority, or other changes that would

affect the baseline workload and work content).

The PGS committee felt the PGS plans as developed
by the committee and the total reliance upon TQM as
the philosophical underpinning of the organization
met the criteria for a successful PGS
implementation. In the face of extraordinary
budget reductions, it may be necessary to reassess
and possibly terminate the program for the duration
of the crisis. Specific agreement may be possible,
however, using the suggestion from DoD 5010.31G
which states the following: "Where industrially
funded operations are involved, this (lower prices
to customers) may be accomplished by including the
anticipated shared value (Navy share - not the
employees' share) as a part of the annual
stabilized rate or a part of the future
reapplication of excess funds in the next budgeting
cycle."

Conclusions

Gain sharing works in industrial environments to
include those encountered in the Federal
Government. Gain sharing is based on the same
principles as TQM and simply provides a
reinforcement mechanism for the philosophy of TQM.
Gain sharing should enhance the implementation of
TQM. Barriers do exist, however, in application of
rules and regulations by the uninitiated at several
layers within the DoD. Although fully endorsed
within the DoD and OMB, NAVAVNDEPOT Cherry Point
still can expect issues to surface, especially in
the areas of financial management, that will
threaten the program. These issues concerning
financial barriers will be pursued through the
chain of command to assure the PGS program remains
viable.

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Quality Improvement Prototype: Internal Revenue Service --One Stop Account Service--Department of the Treasury

The President's Productivity Improvement Program
Office of Management and Budget
(Undated)

Foreword

To further the President's Productivity Improvement Program, I am pleased to announce the designation of the Internal Revenue Service as a Quality Improvement Prototype. A prototype organization demonstrates an extraordinary commitment to quality improvement, focuses attention on satisfying its customers and establishes high standards of quality, timeliness and efficiency. This kind of organization also serves as a model for the rest of the government — showing how a commitment to quality leads to better and more efficient services and products for its customers.

The Internal Revenue Service is establishing an organizational culture that emphasizes quality throughout the Service, from the Commissioner down to the newest employee. This is being achieved by installing a quality improvement process throughout the organization, orienting employees on the agency's commitment to the process, and promoting quality as first among equals with schedule and cost.

An example of the IRS quality approach is the One-Stop Account Service Quality Improvement Project being piloted in San Francisco. Emulating similar programs in private industry, the Service saw an opportunity to improve customer service and reduce taxpayers' frustrations by resolving their account-related problems at the initial point of contact. Results to date show that the San Francisco office has been able to respond fully to certain categories of taxpayer inquiries and problems in 9 days compared to 45 days under the prior system. These improvements are now being considered for other IRS district offices.

Numerous quality improvement projects are under way in IRS involving tax processing, examination, taxpayer service, and other functions. This case study of total quality management at the Internal Revenue Service is being provided so we can all learn from the approaches used and emulate the actions taken. The Internal Revenue Service provides a fine example of how to make the government work better for the people it serves.
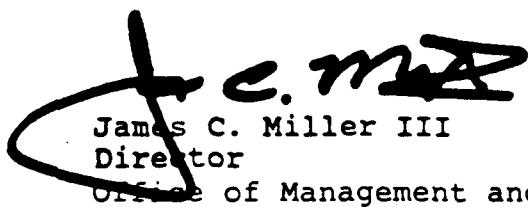
James C. Miller III
Director
Office of Management and Budget

Executive Summary

Commissioner Lawrence B. Gibbs has committed the Internal Revenue Service to a long-term process that will integrate quality into all aspects of the Service and provide quality service to the taxpaying public.

In January 1986, the Commissioner's Quality Council was established. The Quality Council consulted with major quality leaders and its recommendations led to the establishment of a quality improvement process based upon the principles of Dr. Joseph M. Juran. This is a top-down process in which executives were first trained in the Juran approach and then managers and quality facilitators and team leaders.

Quality improvement teams were formed throughout the Service to address specific problems. Initiatives were added to the Strategic Issues Plan to emphasize a commitment to quality, a concern for the customer, and the use of information systems to track progress in meeting the commitment to quality service. In addition, IRS management and the National Treasury Employees Union, in partnership, have agreed to orient all employees in the quality improvement process and to establish joint quality councils in IRS facilities to identify and remedy quality problems.

Quality improvements already brought about in the Service are illustrated by the work done on the One-Stop Account Service project.

One-Stop Account Service

A quality improvement team was formed to reduce the lengthy delays and high costs associated with the resolution of taxpayer account problems. The San Francisco District Office took the lead on this problem. The goal was to increase responsiveness to taxpayers and eliminate the multiple contacts needed to resolve taxpayers' problems.

The team decided to emulate customer service in the private sector by allowing one person to handle a caller's account problem and to remain with the problem until resolved. Previously taxpayers were referred back and forth between the district offices and service centers. Various techniques, such as brainstorming and root cause analysis were used to determine how best to serve the taxpayers in the district offices. The volume of each type of customer inquiry was identified and issues that had the greatest impact and would most benefit the public were selected for improvement.

The pilot One-Stop Account Service resulted from the team's efforts. Tests to date show that the San Francisco District Office is able to respond fully to selected taxpayer inquiries in a fraction of the time required under the prior system. Phase 2 of the project, expanding the number of employees and types of adjustments involved, began in March 1988. Also included in this phase is a test of oral testimony which will reduce the amount of paperwork prepared by the taxpayer and speed up the resolution of the problem. Oral testimony is a major step forward to One-Stop Service. These improvements will likely be expanded to other district offices.

Table of Contents

Section 1: Organization Overview

The Mission of the IRS

The purpose of the IRS is to collect the proper amount of tax revenues at the least cost to the public, and in a manner that warrants the highest degree of public confidence in our integrity, efficiency and fairness. To achieve that purpose, we will:

- Encourage and achieve the highest possible degree of voluntary compliance in accordance with the tax laws and regulations;

- Advise the public of their rights and responsibilities;

- Determine the extent of compliance and the causes of noncompliance;

- Do all things needed for the proper administration and enforcement of the tax laws; and

- Continually search for and implement new, more efficient and effective ways of accomplishing our mission.

Quality Improvement in the IRS

Concern for quality has been on-going for many years in the Internal Revenue Service. We have now implemented a quality improvement process that is based on the principles of noted quality expert Dr. Joseph M. Juran. Commissioner Lawrence B. Gibbs committed the IRS to a long term process that will integrate quality into all aspects of the Service. He issued a policy statement with the following Principles of Quality:

- *Establish a quality climate where quality is first among equals with schedule and cost;*

- *Emphasize product and service quality by eliminating systemic flaws during the planning, implementation and operational processes;*

- *Improve responsiveness to the public and other Service components;*

- *Install a quality improvement process in every field and National Office organization; and*

- *Develop evaluating systems consistent with and reflective of the quality principles.*

In the early 1980's, many IRS offices began to study and apply some of the quality improvement theories coming from Japan. Quality circles were started in 1983. In 1984, the Service implemented a strategic plan containing 55 initiatives. One initiative, Increase the Use of On-Line Reviews, studied the feasibility of reviewing work in process rather than after it was completed. Many of the recommendations from that study formed the basis for a quality improvement process at IRS.

In the meantime, several major trends influenced the move toward the quality process.

- The world we work in — i.e., technology, organizations and people — was changing and becoming more complex.

- There was a decreasing public confidence as well as decreasing employee pride within IRS.

- The 1985 filing season problems received significant unfavorable publicity.

- There was grassroots interest in quality within IRS that needed focusing.

- IRS found itself competing with the private sector for performing services.

In January 1986, then-Commissioner Roscoe Egger formed the Commissioner's Quality Council chaired by Charles H. Brennan, then-Regional Commissioner (North Atlantic Region). They studied several of the well-known leaders in the field of quality, e.g., Crosby, Deming, Feigenbaum, and Juran. They decided that Dr. Joseph Juran most closely met the needs of the Service. His management principles of quality planning, quality control, and quality improvement fit in well with our established organization.

As a result of his counsel, we implemented a top-down quality improvement process. All executives attended a two-day quality training course conducted by Dr. Juran. Some of these executives then conducted training sessions for all top-level managers. A group of these executives and managers then trained their subordinate managers.

At the same time, we designed and implemented quality improvement team training. We

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established quality improvement teams throughout the Internal Revenue Service. We then selected quality improvement coordinators in many of the field offices. We also added five strategic initiatives to the Service's Strategic Issues Plan.

- Ensure that functional goals and program effectiveness measures reflect the commitment to quality service.

- Develop a greater concern for the customer.

- Identify and remove barriers to quality and foster a climate of innovation and creativity.

- Instill a commitment to quality.

- Adapt management information systems to track progress in meeting the commitment to quality service.

We have completed the quality awareness phase for managers and are now adapting the quality principles to the Service's operations. The National Treasury Employees Union (NTEU) has joined with us to form the IRS/NTEU Joint Quality Improvement Process. The Commissioner's Quality Council is now the National Quality Council with two NTEU officials as members. Over the next several months, we will focus on bringing both NTEU and our employees into the process smoothly.

Section 2: Program Background

The Internal Revenue Service receives more than 190 million tax returns each year. Taxpayer Service Division is the customer service segment of the IRS. Workers in Taxpayer Service Division are responsible for answering questions on a wide range of issues concerning tax law, procedures and accounts (e.g., delayed refunds, notices regarding amounts due, delinquent payments, penalties, omissions of income, etc.). Last year the IRS answered more than 55 million account-related inquiries from taxpayers nationwide.

The San Francisco District's Oakland Telephone Tax Assistance Center employs 350 people to answer over 2.5 million calls from customers in Northern California and Nevada. Approximately one-fourth of the calls received concern account-related issues. Of these, more than 400,000 were referred to a service center for resolution by the district office.

> *"...San Francisco District recognized that it was not meeting the customers' needs or expectations..."*

As the demand for customer service steadily increased during the past five years, the San Francisco District recognized that it was not meeting the customers' needs or expectations in resolving account problems. Taxpayer Service Division believed it needed to re-examine the way it did business with a goal of increasing customer satisfaction, responsiveness, and productivity.

In the past, Taxpayer Service employees could answer questions about account problems, but had very limited authority to resolve them. Last year over 35 million customers nationwide were advised to write to service centers for the help they needed. The delays and red tape involved led to frustration on the part of both employees and customers, resentment, and an impression of poor IRS quality in the extremely sensitive area of account adjustments.

Customers perceived a large discrepancy between how their account problems were handled by the private sector and what they experienced with the IRS.

> *"Customers perceived a large discrepancy between how their account problems were handled by the private sector and what they experienced with the IRS."*

In November 1985, IRS gave Taxpayer Service Division employees authority to resolve a wide variety of account problems that had previously been the sole responsibility of the service centers. On the surface this was a giant step forward. Unfortunately, the skills and knowledge necessary to perform this work resided in the service centers and was not readily available to district office employees.

District training materials were inadequate. Training was focused on providing the status of a customer's refund and its progress through the service center. District employees were trained to resolve only a few problems and to give status updates.

Service centers and district offices are different in many ways. Service centers are factories designed to process income tax returns and have little direct contact with taxpayers. District offices, on the other hand, are not directly involved in the processing of tax refunds. While work is transferred back and forth, few districts have close, personal working relationships with their colleagues in the service centers. The San Francisco District Office felt that they would need to form an alliance with their service center counterparts to realize the potential afforded by the new expanded authority.

The Fresno Service Center agreed to participate in a team effort to establish and test a new way of doing business that would be mutually beneficial and would not impact negatively on either office's operation.

Five Major Objectives

The effort to emulate the private sector's responsiveness had the following major objectives:

1. Increase responsiveness to customer inquiries.

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2. Reduce customer and employee frustration.

3. Reduce costs.

4. Reduce multiple customer contacts.

5. Reduce the number of cases transferred between the district office and the service center.

Advising customers to write the service center for help or transferring work-in-progress, because resolution was beyond the scope of the district's skills and/or authority, caused lengthy delays. Frequently, customers called several times to follow up on the status of their requests. This generated unnecessary multiple contacts and higher telecommunication and staffing costs. Customers were naturally upset with what they concluded were unnecessary delays and/or the poor quality ot IRS service. Employees wanted to help customers on their initial contact and were frustrated at being caught between the customers' expectations and IRS's accepted way of doing business. The employees' level of job satisfaction was inversely proportional to the customers' level of anger or frustration, and their perception of IRS's unresponsiveness.

> "Customers were naturally upset with what they concluded were unnecessary delays and/or the poor quality of IRS service."

When lengthy delays exceed what IRS terms "normal processing times," customers are eligible for special service through the Problem Resolution Program (PRP), which assures the customer has somewhere to turn when the system fails. Problem Resolution Program cases represent rework and are very costly to resolve. One-stop service is expected to reduce receipts and costs in this program.

Section 3: Management Techniques and Methodologies Employed

Formation of a Quality Improvement Team

A Quality Improvement Team was formed with five managers and one analyst from IRS's San Francisco District, Fresno Service Center, and Western Region staff. Its purpose is to improve responsiveness to customers with account problems. The team received training in the quality improvement process and is following the eight steps in the Service's problem solving process based on Dr. Juran's approach as shown below:

Step 1: Identify Problems
Step 2: Select a Problem
Step 3: Analyze Root Causes
Step 4: Identify Possible Solutions
Step 5: Select Solution
Step 6: Test Solution
Step 7: Implement Solution
Step 8: Track Effectiveness

Based on interviews, the team determined that district offices were not prepared to handle inquiries using the expanded adjustments authority and that the current level of responsiveness offered to customers was causing lengthy delays, unnecessary additional costs and PRP cases.

Expanded accounts authority gave the districts the go-ahead to adjust customers' accounts, but did not outline how to accomplish the work. Implementation was left to each local office's discretion. As there was a definite lack of any clear guidelines, the team had to ask themselves several questions:

1. **What specifically does the expanded authority encompass?**
   Guidelines were vague.

2. **Who should do the work?**
   Issues needed to be identified that could be worked in the district office versus those needing resolution in the service center.

3. **Can a district office be as effective and efficient as a service center?**
   The work has always been done in the service centers and the skills and resources are there; however, the taxpayers are contacting the district offices for help. District offices had to have the ability to provide comparable service dependably and accurately.

4. **What would it take to accomplish this work?**
   The districts' needs in all areas (e.g., planning, staffing, work flows, inventory control, training and procedures) had to be reviewed and the barriers to change identified.

5. **What impact would district offices have on the service center operations?**
   There was a mutual concern that district offices would generate re-work for service centers in the accounting, unpostables and problem resolution programs if input was not done accurately.

To identify the major barriers in district offices which mandate referrals to service centers, a brainstorming session was held and employees were interviewed. A fishbone chart was made listing the barriers identified. (See next page.)

The Juran Method is Selected as a Tool to Identify Barriers

The Juran method of quality improvement is usually used to identify problems in an existing process. Since a new process or way of doing business was being implemented, the team identified as many barriers as possible instead of concentrating on selecting the "vital few." The barriers in their entirety had to be considered in order for the new operation to function effectively.

During the first phase of the project only four issues were selected for testing to keep the test small for control purposes. The issues selected tested the ability of a correspondence unit to work from customers' copies, to hold on to a case pend-

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Barriers Resulting in Referrals

Policies — Suspense Files Needed · Solicit Substantiation · Quality Review Guidelines · Original Returns · Management Review · D.Q. Research Capabilities Limited

Equipment — Computer for Inventory Control · Locking Files for Suspense · IDRS Terminals · Space

Non-Responsive to Taxpayers

Procedures — Reports and Inventory Control · Disclosure · Desk Procedures Inadequate · Security · Service Center Manuals Needed

People — Training No Processing Bkgrd · Staffing (Technical vs. Accounts) · Clerical Support · Coursebooks Inadequate · Lack of Coaches and Instructors

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ing further action instead of transferring it, to order original returns when necessary, to receive timely service center reports, to identify staffing needs and to receive adequate training.

Other factors used in selecting the four correspondence issues included the complexity of the issue, the amount of judgment and analysis needed to resolve the problem, equipment needs, the impact on service center functions, the degree of training needed, and the anticipated volume of receipts.

> *Analysis had to be made concerning the complexity of the issue, the amount of judgment and study needed to resolve the issue, equipment needs, impact on the service center functions, training, and the anticipated volume of receipts.*

Correspondence caseworkers were primarily impacted, as well as half of the telephone assisters. A limited number of telephone assisters were used to identify issues to be worked in the district and to solicit the required documentation and substantiation, thereby controlling the number of receipts.

Additionally, the district tested the feasibility of immediately transferring customers' calls directly to the service center when the district could not resolve the problem, rather than asking customers to write.

Issues Selected for Phase I

The issues chosen to test in Phase I were:

1. Stopped refund due to missing signature or W-2.

2. Stopped or returned checks.

3. Penalty abatements (except civil fraud).

4. Interest computation and refund on credit elect reversals (the reversal of a decision to apply a refund to next year's taxes), and invalid Social Security numbers due to IRS processing errors.

5. Transfer of telephone calls received in toll-free telephone sites directly to the service center.

The team determined that of 63 possible adjustments the district could make, assisters in San Francisco were already doing 25. Phase I expanded the capability to 29; Phase II to 48; and Phase III to 63.

Service center instructors were used to develop training material, to teach classroom courses and be coaches as well as on-the-job instructors. The district office supplied an employee to help the

(Broken Down by Issue)

Issue	Value
Social Security Number Problem	72
Excess Credits	70
Miscellaneous	68
Payment Trace	41
Fact of Filing	32
Unpostable	32
Refund Inquiry	25
Duplicate Return	20
Employer Identification Number Problem	18
Stopped Refund	18
Unreported Income	15
No Original Return	14
Filing Status Problem	10
Refund Hold	7
Computer Reject	3
Unknown	3
Mixed Period	3
Record of Account	2
Taxpayer Error	1
Collection Hold	1

Pareto Analysis of Referrals to the Fresno Service Center by All District Offices' Taxpayer Service Divisions
(Despite Expanded Adjustment Authority)

0 10 20 30 40 50 60 70 80

service center instructors tailor the course material around district employees' previous training. This district employee was then used as an instructor for subsequent classes.

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Section 4: Status of the Program

Initial Implementation Was Not Without Its Problems

Many of the problems identified in the fishbone analysis did arise, as well as a few unexpected ones. The greatest problems encountered were inadequate training materials, a lack of qualified district office coaches, adapting the present quality review system to meet the needs of the test, differences of opinion in judgment calls between the Quality Review staff and the coaching staff, securing original returns, and generating custom-made letters prepared on a computer.

In the past, the preponderance of account referrals fell in the category of refund inquiries and training focused on the research needed to answer them. The procedures and training required little account analysis and little understanding of service center processing. Any inquiries that required in-depth research or contact by the service center were referred there. Instead of encouraging analysis and judgment, employees were limited to clear-cut situations. Employees' account skills fell short in the areas of account analysis and judgment, both needed for this work.

In order to meet the needs under the expanded adjustment authority, employees needed to understand the account completely so they could analyze the entire situation, then focus in on problem identification and resolution. Since training materials were inadequate, San Francisco District and Fresno Service Center have jointly developed course material relating to skills and procedures and a training plan to meet the needs of the project.

The service center coaches returned to reinforce prior training and to be sure work was still being done as taught. "Quality Coaches" were selected from the ranks of Quality Reviewers to coach caseworkers at the beginning of the training process rather than just identifying errors in the end product. This had a positive impact on employee morale, it bolstered our coaching staff, eliminated tension between employees and reviewers, and improved the quality of service offered to customers.

Also, receipt of computer terminals with word processing capabilities will allow caseworkers to generate customized letters.

It was determined that, in the future, issues to be worked in the district would be restricted to those not requiring an original return. This would be reconsidered at a later date if something could be done to insure timely receipt of requested documents. The number of possible adjustments was reduced to 62.

Phase I Results

Cases Worked in Phase I

Excess Credits 68
Credit Elect and Interest 203
Penalty Abatements 531
Stopped Refunds 495
Total Cases 1,297

Issues involved in Phase I cases.

Closed in 21-30 Days 94
Closed in 31 or More Days 18
Closed in 11-20 Days 256
Closed in 1-10 Days 929
Total Cases 1,297

Number of Days to Close
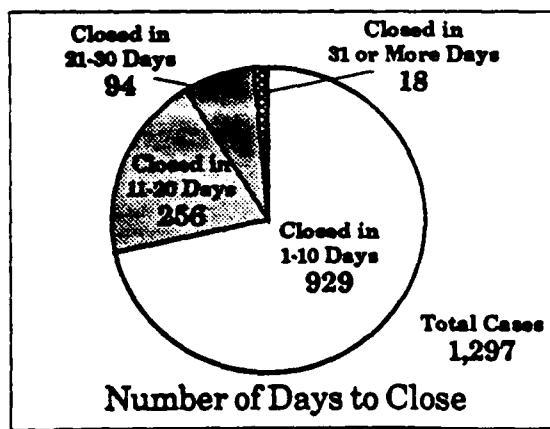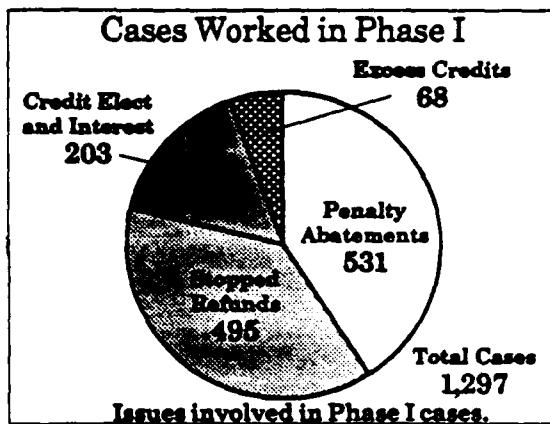
During the Phase I test, the correspondence unit resolved 1,297 inquiries. Though a small percentage of inquiries compared to the number of calls received in the toll-free telephone site during May through September 1987, these 1,297 cases represent issues that previously would have been

sent to the service center for resolution. On average, these cases were closed in 8.9 days, resulting in a reduction of work time, less interest paid to customers and considerable improvement in the Service's responsiveness compared to the previous average of 45 days.

Phase II of the Test Begins

In March of 1988, Phase II was implemented incorporating the Phase I solutions into the everyday work practices of the entire staff. The number of correspondence issues was increased to include account maintenance and numerous, more complex adjustments. In addition, all employees would participate instead of a limited number.

It was apparent to the team that even expanded account authority did not go far enough in changing IRS's procedures to be more in tune with accepted practice in the private sector. A customer calling IRS still had to send a signed statement authorizing account changes. Phase II was expanded to test accepting oral testimony as authorization for account adjustments. This is a significant departure from standard operating procedures and is a major step forward to One-Stop Service. The San Francisco District recognizes the inherent risks in assuming additional responsibility and authority but feels that they are acceptable in achieving customer satisfaction and efficiency.

> *Additional responsibility and authority carry with them inherent risks, but those risks are the trade-off for customer satisfaction and efficiency.*

Oral testimony is being tested in resolving the following issues:

1. **Penalty abatements due to reasonable cause.**

2. **Refund releases due to credit elect reversals.**

3. **Undeliverable refund releases.**

4. **Name correction.**

5. **Excess payments.**

6. **Refund releases due to invalid Social Security number.**

Although accepting oral testimony has only been in effect since March 1988, responses to the customer satisfaction surveys have been favorable. Also, there has been no indication of erroneous or improper adjustment action by employees. Employees are very enthusiastic and there has been a definite improvement in morale. They feel that they have a more important role in the organization and have more opportunities to exercise judgment and make decisions. The employees have whole-heartedly assumed ownership of this quality improvement project because they feel that it has eliminated restrictions that impede their ability to work effectively.

> *"The employees have whole-heartedly assumed ownership of this quality improvement project because they feel that it has eliminated restrictions that impede their ability to work effectively."*

The results are impressive. Preliminary results of Phase II indicate that 400 to 500 new customer inquiries are being resolved each week due to these innovations.

Expectations for Phase III

Phase III of the project, beginning in early 1989, will address mathematical mistakes made on tax returns. The team will try to identify which math errors can be handled by telephone and which require correspondence. Phase II training will be the foundation for Phase III skills. Phase III assisters will be able to research and identify account discrepancies based on minimal information.

What are the Benefits?

The team does not feel that it is appropriate to quantify benefits at this point in the project. Results from Phase I showed that 1,297 customer account adjustments were made on the four issues included in the test. The scope of Phase I was limited to a small group of employees for control purposes.

The resulting data is not representative of the universe on the four issues tested. For these reasons, the team is reluctant to project what the benefits would have been if Phase I has been fully implemented.

Benefits are, however, expected to accrue in the following areas:

1. Tangible Benefits

a. **Reduction in total time to work account inquiries presently referred to service centers:** When account inquiries are referred to service centers, all work done by the districts (e.g., research, acknowledgment letters, inventory control, etc.) are repeated by the service centers prior to resolution. By working these inquiries in the district, we would eliminate this duplication of effort.

b. **Reduction in interest paid to taxpayers:** The team believed that the new procedures of handling account inquiries would reduce the time it takes to release a refund by four to six weeks. This would result in a savings of interest due on these results.

c. **Reduction in the number of Problem Resolution cases:** The team believed that one-stop service would result in long-term reductions of up to 50% in the number of expensive problem resolution cases.

d. **Reduction in the number of multiple follow-up contacts:** By reducing IRS's "normal processing time" on refund inquiries through one-stop service, the team expected to reduce the number of follow-up customer contacts. This would result in savings of telecommunications and staff costs.

2. Intangible Benefits

a. **Increased customer satisfaction:** The quality improvement project will increase responsiveness to customers while decreasing multiple contacts and delays. It will bring IRS more in line with the service provided in the private sector. It is expected to improve IRS's image by meeting more of the customers' expectations and reducing the frustration and resentment they experience while coping with the current system.

b. **Increased voluntary compliance:** This project should help dispel the perception of poor IRS quality in the sensitive area of account adjustments. This should raise the taxpayer's confidence in IRS and strengthen voluntary compliance.

c. **Improved efficiency:** Due to this quality improvement project, the San Francisco District has developed a close association with the Fresno Service Center. Exchanges of information have helped the district refine its procedures and increase its efficiency.

d. **Improved employee morale:** Employees were expected to derive more job satisfaction from being able to help customers themselves rather than referring them to another office. The concept of one-stop service was expected to benefit both the customers and the staff.

> *"The Internal Revenue Service has created a climate where quality is placed first and an environment where creativity and innovation can flourish."*

The Internal Revenue Service has created a climate where quality is placed first and an environment where creativity and innovation can flourish. This climate has started managers thinking in new ways and questioning long held views on the best way to do business. There is a new receptiveness to different points of view and recognition that there is no one best way.

Some examples of innovation that have resulted from the quality climate in the San Francisco District and Fresno Service Center are:

1. Providing customer service from 7:00 a.m. to 10:00 p.m. Monday through Friday; and January through April 15th, from 9:00 a.m. to 5:00 p.m. on Saturdays and from 1:00 p.m. to 5:00 p.m. on Sundays.

2. Creating a tax practitioner hotline that gives our colleagues in the community immediate access to an account-trained employee.

3. Testing high speed facsimile transmission of customer information to service centers and districts has improved service to customers and their representatives.

4. Establishment of a district office liaison in the Fresno Service Center to be a resource that provides information on processing procedures.

The joint One-Stop Account Service quality improvement project has fostered mutual trust, open

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communication and teamwork. When it began, the San Francisco District and the Fresno Service Center spoke two different languages. Now that they understand each other's operation, they have an increased awareness of each other's needs. In one instance, a minor adjustment of standard procedures by one office provided the opportunity for the other to increase efficiency.

Communication is not limited to team members. Results and innovations are being shared with other districts and service centers. Ideas for future consideration include rewriting district training materials, use of an automated call routing device, and direct issuance of refund checks.

Section 5: Key Personnel

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Questions may be directed to Ms. Bagdasarian or Mr. Abbott, whose telephone numbers are listed above.

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Quality Improvement Prototype: Equal Employment Opportunity Commission

The President's Productivity Improvement Program
Office of Management and Budget
(Undated)

Foreword

To further the President's Productivity Improvement Program, I am pleased to announce the designation of the Equal Employment Opportunity Commission (EEOC) as a Quality Improvement Prototype. A prototype organization demonstrates an extraordinary commitment to quality improvement, focuses attention on satisfying its customers and establishes high standards of quality, timeliness and efficiency. This kind of organization also serves as a model for the rest of the government — showing how a commitment to quality leads to better and more efficient services and products for its customers.

The Equal Employment Opportunity Commission has successfully applied quality assurance strategies to case investigation and other Commission operations. While reducing the time to process discrimination cases in many district offices, the Equal Employment Opportunity Commission is improving the overall quality of its investigative work. Quality assurance techniques are being applied in the EEOC district offices. For example, in Charlotte, North Carolina average processing time per case declined from 303 days in 1986 to 251 days in 1987 and is still declining. The efficiency of investigators also improved. In 1987, each investigator resolved an average of 74 cases compared to 61 cases in 1986.

EEOC is the first to acknowledge that the agency is in the early stages of applying total quality management throughout the entire Commission. Nevertheless, this case study demonstrates approaches and techniques that can be effectively used in Federal settings. The Commission is providing a fine example of how to make the government work better for the people it serves.

James C. Miller III
Director
Office of Management and Budget

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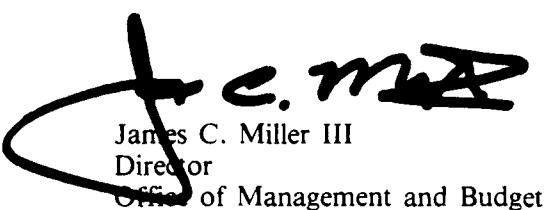
Executive Summary

The Equal Employment Opportunity Commission (EEOC) enforces Title VII of the Civil Rights Act of 1964 which prohibits employment discrimination; the Age Discrimination in Employment Act of 1967; the Equal Pay Act of 1963; and prohibitions in the Federal sector against discrimination of the handicapped. Through 23 district offices and Washington, D.C. headquarters, receiving complaints, investigation of charges, and resolution through either conciliation or litigation are the primary activities of the EEOC.

Because internal management systems (finance, accounting, personnel/payroll) were outmoded, organizational structures were deemed unresponsive, staff development programs were weak and ineffectual, and the quality and timeliness of handling cases were poor and unresponsive to customer needs, the Commission initiated in 1982 a broad-based strategy for improvement. The centerpiece of the improvement effort, called Quality Assurance (QA), was designed and launched in 1984 in six test sites.

The methods of statistical process control and a strong participation process were adapted to the special case handling needs of EEOC and are at the heart of the Quality Assurance process as it is being expanded to cover all field offices. Like many organizations involved in quality improvement, EEOC realized by the second year of implementation, that these activities alone were not sufficient to create the enormous cultural changes that were needed. This would necessitate extensive training of managers and employees, more cooperative relations with the union, improved teamwork, formal employee participation in the Quality Assurance process, and major efforts to change managerial attitudes about the changes occurring.

The Quality Assurance process at EEOC as it now exists can best be described under the rubric of the management of work and the leadership of people. These two dimensions foster a dual set of improvement goals.

To achieve these dual sets of goals throughout the EEOC, the Quality Assurance effort is directed toward enabling every local office to lead its own change effort. Quality Assurance facilitators work with management in the individual offices to:

— Develop relationships of trust with top leadership

— Establish a strong management team through leadership training and team building

— Train the team in QA management concepts: systems theory, quality control

— Lead the team in a joint analysis of the problems and issues facing that particular office

— Facilitate the planning of both short and long-range strategies to address major concerns, including technical training

— Develop team ownership of both problems and solutions

— Design and install a quality measurement process

— Prepare the management team for employee involvement.

EEOC's experience with Quality Assurance reinforces the experience of other organizations involved in total quality improvement: the process is long-term in nature and few shortcuts work. Overall results, however, occur in every significant area and attest to the strength and depth of the QA change process. At EEOC significant progress has occurred in the quality of investigations, the strength of the litigation program, the professionalism and morale of staff, the processing of cases, the quality of the work environment and office space, efficiency in performance, feedback from clients, and attitudes of managers. Section 5 provides a summary of specific gains in these areas in five district offices and three headquarters' offices.

Although early achievements are impressive and have earned EEOC the designation of a government-wide Quality Improvement Prototype, the agency emphasizes that much still remains to be done to institutionalize Total Quality Management throughout all its operations.

Table of Contents

Section 1
Organization Overview

The Equal Employment Opportunity Commission is the Federal agency charged with enforcing the laws that concern the elimination of discrimination in employment. These statutes include Title VII of the Civil Rights Act of 1964, as amended, which prohibits employment discrimination based on race, color, religion, sex, or national origin, the Age Discrimination in Employment Act of 1967, as amended, and the Equal Pay Act of 1963. In addition, the EEOC enforces Section 501 of the Rehabilitation Act of 1973, as amended, which prohibits handicap discrimination in the Federal sector.

EEOC has five Commissioners and a general counsel appointed by the President. The Commissioners are responsible for establishing and administering agency policies. The General Counsel is responsible for conducting Commission enforcement litigation. Approximately 3,000 employees in 50 field offices and at headquarters in Washington, D.C. implement the policies and programs designed to ensure equal employment opportunity.

There are 23 district offices nation-wide whose primary responsibility is to receive, investigate and resolve discrimination complaints. The districts encompass distinct geographical areas and provide services in investigation of charges; litigation; Federal affirmative action; hearings on Federal employee complaints; and oversight of contracts with some 100 state and local fair employment practices agencies which receive and process about 40 percent of the agency's total charges. In addition to district offices, there are 27 smaller area and local offices as well; these offices report to the districts and focus their efforts primarily on the investigation of charges.

Individuals who believe they have been discriminated against in the workplace file complaints with EEOC. These complaints are received by investigators in field offices, who counsel complainants regarding the laws administered by EEOC. After counseling, complainants decide whether to file a formal charge. Charges are investigated on the merits to determine if discrimination has occurred.

An investigation into the merits of a charge can result in findings of probable cause or no cause. A cause finding means the evidence is sufficient to give a reasonable person cause to believe discrimination has taken place. Once cause has been found, the agency attempts to reach a conciliation agreement with the employer that will remedy the alleged discrimination. If attempts at conciliation fail, cause cases are recommended to the Commissioners for approval of litigation in Federal district court.

Any time that no cause is found (i.e., based on the evidence, a reasonable person would have no cause to believe discrimination had taken place), both the complainant and the employer are advised of the agency's determination. Once the determination has been made, the complainant may either accept the no cause determination without further action, appeal the determination for a higher-level review in EEOC or file a private law suit in Federal court.

EEOC's mission statement was developed in 1982 by Chairman Clarence Thomas, the Commissioners and the agency's senior managers.

Equal Employment Opportunity Commission Mission Statement

To ensure equality of opportunity by vigorously enforcing legislation prohibiting discrimination in employment through investigation, coordination, regulation in the Federal sector, and through education, policy research and provision of technical assistance.

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Section 2
Program Background

Problems with Quality and Timeliness of Services

Since its inception in 1965, EEOC has struggled with the demands of conducting investigations that meet both quality and timeliness standards. When caseloads are high, much of the investigator's time is spent answering inquiries on the progress of cases. Also, the longer a case stays open, the more difficult it is to find witnesses and the less certain their memory of events. Delays and inefficiencies increase, and both quality and timeliness begin to suffer. The investigator gets bogged down in the existing caseload and cannot accept new cases. In a snowball effect, multiplied by many investigators, production continues to decline and the entire district office inventory grows.

In 1982 through rapid processing procedures and pre-determination settlements, the agency had just succeeded in reducing its inventory from over 100,000 cases in 1977 to less than 34,000, but its credibility as a law enforcement agency was at an alltime low. Criticism for inadequate investigation and inappropriate settlements was directed at the Commission from every quarter, including Congress, the General Accounting Office and constituent groups. Neither charging parties nor employers had confidence in EEOC's ability to render a fair decision on the merits of the case or to ensure enforcement of the law where violations had occurred. To satisfy its clients and the public, EEOC clearly had to reemphasize quality.

The challenge was how to do this in such a way that the inventory did not slide out of control, thereby undermining quality as well as timeliness standards.

Other serious agency problems further complicated the picture in 1982-83, adding to the difficulty of addressing the quality challenge.

- Essential financial, personnel and management systems were weak or non-existent.

- Computer systems were outmoded and inefficient. Only manual case tracking was possible at the district office level, resulting in over-burdened district managers and an error-prone national database.

- Staff resources were declining while charge receipts were growing.

- Little or no training capacity existed.

- Low morale was pervasive, with poor communication and lack of teamwork evident everywhere. Union-management relationships were strained.

Strategy for Change

Given the complexity of the agency's problems and its history of many unsuccessful efforts at improvement, Chairman Thomas decided to try for a permanent solution to both quality and timeliness issues by adopting Total Quality Management (TQM) at EEOC. In 1983 the Commission's ultimate goal — becoming a highly professional Federal law enforcement agency that routinely provides efficient and high quality services to its clients — seemed very distant. Using TQM as the vehicle for getting there seemed quite risky, since improvements promised to be slow in coming and the approach was difficult to install. Nevertheless, EEOC opted for a possible permanent solution instead of another attempt at a short-term answer.

Laying the Foundation for Quality and Timely Production

Total Quality Management, or Quality Assurance as it became known at EEOC, is not a program that can be set down whole or unchanged in an organization. Rather, it consists of an inter-related set of concepts and theory-based techniques which must be tailored not only to fit the entire organization, but each of its suboffices or departments. EEOC's Quality Assurance program, which mainly focused on field offices where complaints are received and resolved, was developed in 1983 and 1984 by designing, testing and redesigning various approaches.

From the beginning, QA considered that field offices were customers and that QA services must help instead of direct field improvement. Thus, representative field directors and managers participated fully in the original QA design stages, and still work with QA staff to reshape the approach as needs change. Implementation into all 23 district offices and 10 headquarters offices was planned to be phased in over a four-year period from 1985-1988.

As the new approach was being tested and installed, the agency took a number of related actions which supported the fledgling Quality Assurance thrust:

- Restructured units in field offices to enable all investigators to conduct full investigations, and to handle the same case from receipt to closure

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- Established a Determinations Review Program to allow charging parties to request headquarters review of their cases when field investigations resulted in determinations of "no cause"

- Developed a new Charge Data System with automated local data base for field offices

- Strengthened all fiscal and management systems with special attention to field needs

- Revised performance agreements with field managers to include quality and participative management standards; initiated recruitment programs to attract highly skilled staff; reclassified field personnel from Equal Opportunity Specialists in the 360 series to the 1810 Investigator series

- Created a comprehensive training program to address staff development needs

- Negotiated a new collective bargaining agreement which established a Joint National Quality of Work Life Committee to improve labor-management relations.

The five-member Commission also issued three new policy statements setting forth EEOC's firm intent to achieve the highest standards of law enforcement.

EEOC POLICY STATEMENTS

Investigative Compliance Policy:
Provided for thorough, focused and expeditious investigation of discrimination charges.

Enforcement Policy:
Established the goal of pursuing through litigation each case in which merit has been found and conciliation has failed.

Remedies and Relief Policy:
Ensured "make whole" relief for all individuals directly aggrieved by violations of EEO laws.

Management Techniques and Methodologies Employed

Total Quality Management

Total Quality Management (TQM) is a management approach based on the methods Japan used to earn worldwide acclaim for its remarkable achievements in quality and productivity in the years following World War II. TQM takes an overall systems view of an organization, including its mission, environment and customers as well as its culture, operational processes and the people who perform the work. In recent years a number of American corporations have begun to adopt TQM to improve their own competitiveness in world and domestic markets, with increasing success.

Both Japanese and American corporate experiences strongly indicate that full implementation of TQM usually results in having to change nearly everything in an organization.

Characteristics of Total Quality Management

Emphasizes quality and customer/client satisfaction above all other organizational goals, including production and profit

Relies heavily on Dr. W. Edwards Deming's application of statistical quality control to production processes

Increases productivity as quality improves. Production may decrease during initial stages of the quality effort, but doing work right the first time eventually results in productivity gains as well customer satisfaction

Takes a long time to install completely — from 6 to 12 years — and eventually addresses every aspect of the organization

Involves in-depth systems analysis, experimentation and usually some early mistakes and false starts as concepts are tailored to fit the organization

Requires basic changes in organization culture and attitude of people

Calls for patience and commitment at all levels, especially during early stages

Is never finished; instead, sets in motion a continuous process of improvement. Real pay-offs occur in the long term but are enduring.

Underlying Concepts

EEOC's analysis of TQM theory concluded that there are two equally significant dimensions essential to effective organizational performance: management of the work to be performed and leadership of the people connected to the organization. Within each of these dimensions, QA identified several key concepts (see Table on page 5) that affect quality and timeliness or productivity outcomes.

Installing QA in a District Office

QA's goal is to enable individual offices to achieve quality and production improvements through the application of the underlying concepts in a progression of steps. QA facilitators work together with managers in individual offices to:

1. **Develop relationship of trust and confidence with office director.**

   An essential first step in every QA initiative is to gain the support of the office director. This is done through personal discussion and frank exchanges about the program, enlisting the director's own desire for high performance to create a sense of partnership with mutual goals. Often the director's

initial commitment is provisional: "I'll try it for awhile and see what happens." As the QA process unfolds and improvements are noted without any negative consequences, the director usually places more and more reliance on QA staff for consulting assistance, resources and/or direct interventions. Problems in the QA/director relationship at any stage inevitably result in a less effective improvement effort.

2. **Establish a strong management team through leadership and team building.**

   A Management Quality Circle (MQC), composed of the director and all managers and supervisors in the office, is established at the beginning of a QA effort and becomes the driving force for quality in that office. One of the first activities is to hold confidential interviews with members of the MQC, asking each member: "What are the best things about this office? What needs improvement? What is the quality of work in this office? What is the climate or people environment like?" A summary of these data is presented to the MQC and serves as the first,

4

HIGH QUALITY PERFORMANCE
is achieved through

MANAGEMENT OF WORK	and	LEADERSHIP OF PEOPLE

Systems Approach

— Understanding of the organization: mission, environment, input process, output, internal and external customer requirements

— Recognition of relationship of parts to whole

— Operations analysis, work flow efficiencies

Participative Climate and Quality Culture

— Open flow of information and feelings

— Less emphasis on hierarchy and more on competence

— Commitment to doing the job right the first time

Quality Measurement

— Careful specification of quality and timeliness requirements based on customer needs

— Data collection on quality performance

— Performance feedback and analysis of indicators

— Use of data to improve quality

Team Management

— Interlocking teams, linked to managers who see their major role as removing obstacles to excellence

— More emphasis on office and unit goals instead of individual performance

— Trust, confidence and good communication among team members

Technical Competence

— Thorough knowledge of EEO laws and their application to individual cases

— Job skills: interviewing, evidence analysis, case development, negotiation, etc.

Staff Involvement

— Unit problem solving and frequent opportunities for making suggestions

— Recognition, support and rewards for achievement: quality first

— Appreciation of individual differences in motivation and achievement needs

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rough-cut diagnosis of office problems and the basis for tailoring QA to that office.

Because the MQC plays such a key role in leading a change effort, a great deal of emphasis is placed on developing the skills of quality circle members. Leadership training includes learning how to assess the office climate and their own leadership styles; and development of leadership skills, such as motivation and communication with staff.

Training to help the MQC work more effectively as a team covers skills in understanding group dynamics, in decision making and communication and conflict management. Team building is especially useful in building cooperation

in the office between units, or between legal and enforcement groups. Extensive use is made of the Myers-Briggs Type Indicator as a basis for team building.

3. **Train the team in QA management concepts; systems theory and quality control.**

Systems theory, the concept of an organization as a system of interdependent parts in which the performance of the whole is affected by the performance of each part, has been a basic tenet in the development of the QA program. A district office learns to define itself as a system of interrelated parts that correspond to the office structure of enforcement, legal, and support units. This system receives inputs and produces outputs at various stages in the case investigation/litigation process.

The use of systems theory encourages the office to see EEOC as a system of interdependent units, all of which influence the other units' work and productivity. Taking a systems view also helps the office chart its own flow of work from unit to unit, and understand that a product coming out of unit "A" must meet certain quality standards to be useful to the people down the line in unit "B", who rely on that product to do their job.

The MQC learns how statistical process control techniques are applied in manufacturing processes and how they could be adapted to case processing at EEOC. (see diagram below).

Key decisions, activities or products in the process are identified; customers (supervisors, top management and legal reviewers) establish quality requirements for each decision or product; data are collected on degree of conformance to quality requirements; feedback on percent and type of defective quality is provided to the producing unit and investigator. Recurring quality problems are flagged for problem solving activities. Statistical process control also calls for constructing control charts to monitor quality performance over time to determine whether variations of quality in the process are caused by individual aberrations or system design flaws.

A major QA objective is to change the way the agency operates from a management system of final inspection and rework to a system based on prevention, where mistakes are recognized while an investigation is still in process rather than after case closure. The earlier that defects in quality are detected, the more efficiently they can be rectified. The ultimate goal, of course, is to achieve a zero defect rate during case processing.

4. **Lead the team in joint analysis of the problems and issues facing that particular office (a frank performance review).**

Using existing office performance outcome data as well as information generated during confidential interviews with the MQC members, QA staff assist the management team to develop a more indepth diagnosis of the office's strengths and weaknesses relative to quality and timeliness outcomes.

CASE PROCESSING SYSTEM

INPUT	PROCESS					OUTPUT
Inquiry/ Complaint	Formal Charge	Investigative Plan	Investigation	Investigative Memo	Determination of Cause/No Cause	Case Resolution: Conciliation, Litigation, Notice of Right to Sue, Etc.
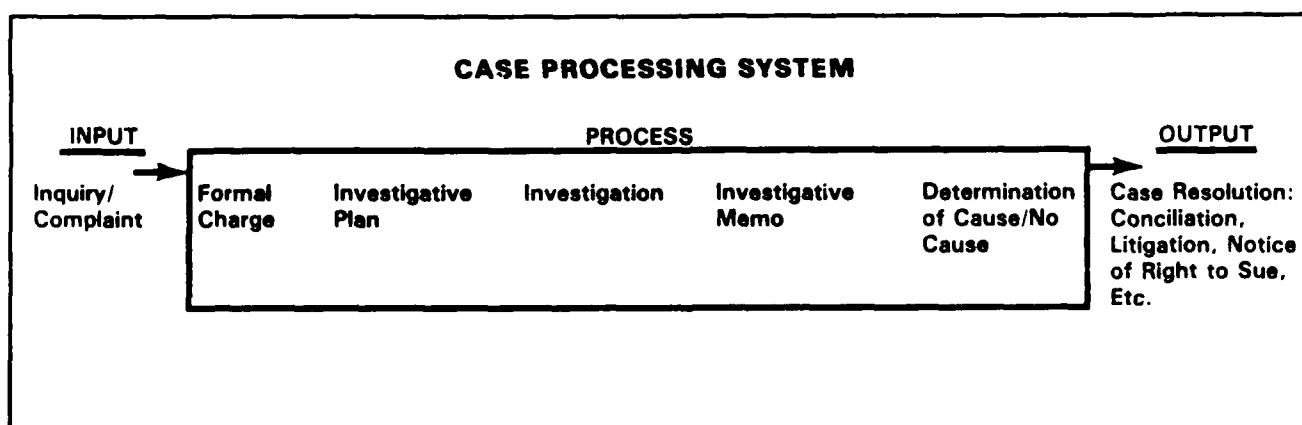
Not only are problems identified, e.g., inappropriate decisions on case findings, but possible reasons are also explored in depth, such as lack of incentive for investigators to do additional investigation, poor communication between attorneys and investigators or insufficient supervisory involvement. Teams are encouraged to get beneath superficial explanations to root causes.

5. **Facilitate the planning of both short and long-term strategies to address the major concerns, including technical training.**

Once problems are identified and diagnosis is complete, QA staff facilitate the team's initial work on generating solutions, setting goals, putting changes into effect, and monitoring results. Where necessary, QA provides additional resources, such as work flow analysis, system re-design, skill development in technical content areas, computerized caseload projection modeling, etc.

6. **Develop team ownership of both the problems and the solutions.**

An integral aspect of QA work with district offices is to create a sense of local ownership as opposed to a feeling that headquarters has determined there is a problem and that the office must implement headquarters' solution. This is often a difficult but essential transition to ensuring that the responsibility for quality — doing it right the first time—lies with each individual and each local office. QA aims to create an ongoing improvement process rather than a one-time QA assisted event.

7. **Design and install a quality measurement process.**

As offices are ready, QA assists in developing a quality measurement process, sometimes for the entire work system, often for a part that is particularly troublesome, such as the charge intake process. Generally, district offices use statistical process control to the extent of establishing quality requirements and taking before and after measures, then re-measuring after longer intervals to check performance. At this time, few offices use quality control charts on a regular basis.

8. **Prepare the management team members to create new teams and involve employees in meaningful participation.**

The emphasis of EEOC's Quality Assurance program on full staff participation requires that supervisors and staff must be involved together in identifying work-related problems in their units and together coming up with solutions. Two steps are key to successful employee involvement in performance improvement:

— Training managers and supervisors in skills necessary for leadership. These skills include climate setting, problem-solving methods, techniques for running effective meetings, team building, and ways to encourage employee participation and creativity.

— Proactive supervisory leadership. Working with their unit employees, supervisors regularly engage their teams in looking at performance data and meeting as a group to brainstorm solutions to problems of work quality and timeliness.

**STEPS FOR INSTALLING QA
IN AN OFFICE**

1. Develop relationship of trust with office director.

2. Establish strong management team.

3. Train team in QA management concepts.

4. Lead team in analysis of office problems, performance.

5. Facilitate planning to address major concerns.

6. Develop team ownership of problems, solutions.

7. Design/install quality measurement process.

8. Prepare management team for employee involvement.

While the program is being installed in an office, the initial investment of QA staff resources is quite high. This period usually lasts from 12 to 24 months, depending upon a number of variables, such as management readiness, existence of serious team conflicts and level of current performance. Once the office takes full ownership and becomes truly responsible for further improvements, QA staff reduce their involvement to "check up" site visits and responding to specific resource requests.

Occassionally QA does not take hold in an office, or functions only when QA staff are present to facilitiate

meetings. These situations call for careful problem analysis by QA and the office itself. In several instances, QA involvement in an office has been put on hold until problems can be understood and worked out.

Staffing the Quality Assurance Program

The Quality Assurance staff is composed of facilitators and compliance trainers who work on-site in field offices to help address both the management of work and leadership of people needs and issues. The facilitators are senior-level program analysts with backgrounds in quality control, systems analysis, quality circle facilitation, organization development, group process, the Myers Briggs Type Indicator and/or training. In addition to the experiences and training each brings to QA, indepth training through formal and informal workshops is provided to ensure that all facilitators are highly skilled in all subject areas. This training is provided by facilitators with the strongest skills in a particular subject, or by outside experts and consultants.

The compliance trainers are former EEOC charge investigators and supervisors with extensive experience and knowledge of EEO laws and procedures. Their task is to work with the QA facilitators and the district office management team to assess training needs in investigative and legal skills in a particular office, and to present recommendations for the best ways to increase the staff's technical competence. Solutions may include the compliance trainer designing and delivering specialized courses, district staff providing in-house training, agencywide course offerings to meet the needs of all staff, etc. Compliance trainers receive extensive training in course design and briefing skills as well as subjects offered to the facilitators.

At present there are six facilitators and four compliance trainers on the QA staff.

Complementary 1987 Headquarters Quality Initiatives

To support the drive for quality and productivity in district offices, headquarters developed a number of complementary programs. These will be further expanded and others developed as field needs change over time.

1. **Training in How to Conduct a Quality Investigation**
   In 1987 all investigators, supervisors and enforcement managers attended a week-long training conference aimed at teaching and reinforcing knowledge and skills required for full investigation of charges.

2. **Leadership Skills for Supervisors and Managers**
   In addition to leadership training in the MQC, supervisors and managers attended a week long program in advanced management training called "The Effective EEOC Leader". The training emphasizes participative management skills and insight into personal leadership styles.

3. **Case Management**
   A study of EEOC and the National Labor Relations Board case management practices was conducted in 1987 to determine in more depth what is needed to improve quality and timeliness of cases. The study focused on case management practices in field offices to identify successful techniques used by managers. The findings and conclusions form the basis for the Chairman's FY 1988 Case Management Initiative which focuses on managing cases to achieve quality while maintaining inventory control.

   A training program which addresses three major areas of the management of field office work is now being piloted with MQCs in seven field offices. It will be delivered Commission-wide in FY 1989 and addresses:

   — Caseload planning, which involves projecting the total annual office caseload, setting monthly and annual unit-by unit objectives, and deciding how resources and efforts will be expended to accomplish these objectives;

   — Case development, which emphasizes the involvement of field managers in the investigation from the beginning of the process to closure (not waiting to inspect a final product at the end of the case);

   — Case tracking, which concerns full implementation and use of the new automated reporting system in the management of the office.

4. **Quality of Work Life**
   In 1987 the Joint National QWL Committee sponsored a Commission-wide QWL Survey. It measured job satisfaction, working conditions, quality of participation in decision-making, relationship with supervisors, and other aspects of agency climate. Union officials, managers and employees in district and headquarters offices will use the national findings and their own office survey response data to plan necessary improvements to enhance the quality of life in their office.

8

Section 4
Current Status of Program

After limited initial testing of QA concepts in six sites in 1984, the first comprehensive QA program was introduced in the Houston District Office in February 1985. QA was then initiated in all remaining districts as well as 10 headquarters offices in three phases over the next four years as planned, with one exception. In one district, QA was installed in a local fair employment practices agency first to discover whether the comprehensive QA approach would be effective in state and local agency settings. That district office is scheduled to begin QA in July 1988.

Designed for maximum flexibility, the QA program was altered in every office to fit local circumstances. In addition, changes in the overall program evolved over the three years to reflect lessons learned. For specific examples of QA application, see the eight office summaries in Section 5. Today QA is still dynamic, adding new aspects as needs emerge and dropping certain applications as problems recede.

In all district offices, QA's major focus has been on improving the quality and timeliness of investigations instead of litigation, because investigation is an earlier stage of case processing. Litigation comes later and indeed is largely dependent for its quality on the thoroughness of the investigation.

At this stage of implementation, EEOC's QA results appear to mirror the experience of industry with TQM. Generally, the longer the program has been in place, the better the outcomes.

Results in District Offices

Of the eight district offices included in Phase I, six now show significant and progressive gains in quality and productivity, and one shows recent clear improvement in productivity. The remaining office, after earlier gains, is currently not progressing as well.

Of the 10 district offices in Phase II, with QA programs about a year old, two show significant quality and productivity gai.. s. In the remaining eight, there are scattered signs of forward movement, but no marked trends. In the five Phase III offices, four with programs less than a year old and one not started, as expected there is little impact to date on performance outcomes.

Section 5 includes brief descriptions of QA program results in five of the Phase I QA district offices. While many variables may contribute to improvements, and weighing the relative value of each is difficult, managers in these offices agree that many of the improvements can be traced to the QA-office partnership. As stated

earlier, the primary QA focus has been on laying the foundation for long term improvement in the quality and timeliness of investigations.

More complete, accurate and timely investigations lead to more reasonable cause determinations, conciliation agreements, and/or litigation filings. At this stage in the QA program, quality and efficiency are primarily measured by existing agency indicators such as cases closed per investigator, size of inventory, average processing time, percent of reasonable cause determinations, number of conciliation agreements reached and/or number of litigation cases filed. Because of the long lead time between initiation of a legal action and its conclusion, sufficient data are not yet available on results of litigation actions to use as an indicator of QA effectiveness. While it is not possible to say for certain that increased litigation filings are due to an improvement in program operations, it is anticipated that improved investigations will show positive results for litigation. Therefore, although increased filings in and of themselves are not dispositive of improved efficiences, these data are being used for the time being to indicate the first stage in improvement that is expected to materialize in the coming years. Additional quality measures of investigations are being developed at the local level through adaptation of statistical process control techniques to the case processing system.

Some examples of results to date are:

— *Houston District Office increased its number of "reasonable cause" determinations from 66 in FY 1986 to 133 in FY 1987, due to improved quality of investigations. Houston also decreased its average processing time per case from 233 days in fourth quarter FY 1987 to 171 days in first quarter FY 1988.*

— *Chicago District Office increased the number of cases closed by 437 from FY 1986 to FY 1987, an 18 percent gain, and increased average closures per investigator from 54.6 in FY 1986 to 77.2 in FY 1987. Chicago also reduced the average waiting interval for charging parties from one hour to less than 15 minutes.*

— *Charlotte District Office increased the number of cases recommended for litigation from 11 in FY 1986 to 35 in FY 1987. Grievances in Charlotte declined from eight in FY 1986 to four in FY 1987 to zero at mid-year 1988.*

— *New Orleans District Office improved its acceptance rate of cases recommended to Commissioners for*

litigation from 55 percent in FY 1985 to 100 percent in FY 1987, due to better quality of investigations and more effective communication between legal and compliance units. New Orleans also reduced its pending inventory by 28 percent from FY 1985 to FY 1987.

— San Francisco District Office increased average closures per investigator by 15 percent from FY 1985 to FY 1986, and by 32 percent from FY 1986 to FY 1987; and increased the annual number of cases recommended for litigation from 11 in FY 1984 to 30 in FY 1985, FY 1986 and FY 1987.

It is hard to generalize bottom-line results across district offices since each chose different objectives and therefore had different measures of success. However, the following conclusions about QA program effectiveness in these five district offices appear sound:

● In every office, management participants affirm improved communication and teamwork.

● Each office can point to significant efficiency and timeliness gains in targeted agency performance outcomes based on before/after measures of improvement efforts.

● Several offices achieved improved quality based on before/after measures from a locally designed quality measurement system. Quality in other offices improved in the view of senior managers, or based on existing agency indicators.

● Of two offices which measured client feedback, one showed significant improvement in client service and the other maintained high client satisfaction while instituting efficiency changes.

Results in Headquarters Offices

In the 10 headquarters offices, the program was fitted around district office schedules. From these experiences, it is clear that QA techniques can be usefully adapted to a wide variety of headquarters functions. Section 5 includes examples of QA in three headquarters offices where before and after results were measured and significant gains made. Several examples follow:

— The Office of Review and Appeals reduced its pending inventory of a high of over 5000 cases in second quarter FY 1987 to less than 2400 at the end of second quarter FY 1988. Case processing time was reduced from two years to an average of less than a year. Over the last two years, the number of annual closures increased by 56 percent to a high in FY 1987 of 5659.

— The Disbursement Section of Financial and Resource Management Services reduced voucher processing time from 12-15 days to 3-5 days, and continues to receive high marks on internal customer satisfaction surveys.

— The agency in-house EEO program reduced the ratio of formal complaints per counseling contact from 78.4 percent in FY 1985 to 55.9 percent in FY 1987, due to improved counseling; and reduced its year-end case inventory from 219 in FY 1985 to 161 in FY 1987, a 26.5 percent reduction, the lowest since 1979.

QA in 1988

One of the less precise but more meaningful measures of QA's role in EEOC's positive development is the difference in attitude of senior executives. In the beginning, office directors would only participate in QA if the Chairman persuaded them to become "volunteers". Now QA gets many and frequent requests for additional assistance such as consultation, training, team building, problem diagnosis, performance analysis, goal-setting, caseload planning, etc.

In FY 1988, seven offices were selected for concentration of the QA effort, based on opportunities for significant improvement. By the end of FY 1988 improvements are anticipated in most of these seven offices as well as continued gains in all Phase I offices. In future years, QA will again be directed toward the development of all district and additional headquarters offices. As the program in each office matures, it is expected that quality and productivity improvements will continue to be realized over a long period of time.

Impact of QA and Other Quality Initiatives on Caseload

Although QA was not to begin phasing programs into district offices until 1985, in 1983 the Chairman called for immediate recommitment to quality of investigations at EEOC. EEOC was to conduct thorough, objective investigations of all charges of discrimination so that both charging parties and respondents would be assured that their cases were being handled with professional skill and consideration.

As extensive new quality initiatives were undertaken, annual case closures declined. For example, in 1987, five major quality improvement programs supplemented the QA effort: training of 1500 investigators and managers in quality investigations, training of half the field managers in leadership skills, restructuring field intake functions, installation of the new automated national database, and initiation of the Determinations Review Program. Absorption of these activities into field operations had a negative impact on productivity in FY 1987 and in the first quarter of FY 1988. These costly investments, however, are expected to yield dividends as offices integrate quality with productivity improvements through QA methods. Early indications from incomplete second quarter data signal that productivity is beginning to recover from these production dips.

Knowing that QA and other TQM efforts are long-term means of achieving overall goals, EEOC finds that results after only 3 1/2 years of sustained effort are encouraging:

— The five Phase I QA district offices described in Section 5 achieved productivity gains in FY 1987, a year when agencywide productivity dropped.

— The agency litigation program has been greatly strengthened. Lawsuits filed in 1986 and 1987 numbered 526 and 523 respectively, the two highest numbers of legal actions filed in EEOC's history.

— Feedback from charging parties, the respondent community, bar associations and constituent groups indicates that respect for EEOC's professionalism is steadily increasing.

QA Lessons Learned

Through our experiences, and especially from our mistakes, we have relearned some old lessons about organizational change and perhaps discovered some new ones:

— The change effort must begin at the top. Commitment of the agency head must remain firm in the face of criticisms, early failures and long time lags before success.

— Collaboration between political and career leadership is crucial.

— Later momentum is based on early buy-in by well-respected agency leaders. It is wise to earn credibility first with those managers who are known for high

standards. Involve field staff as customers in program planning and critique of QA approaches.

— Especially in the beginning, QA runs the risk of being seen as "soft", unrelated to performance outcomes. Usually performance cannot be improved unless the climate is right, so QA most often had to start office-wide improvement with team building. For a while this led to perceptions that QA was a "feel good" program with little relevance to the bottom line. The hard/soft, work/people issues need to be carefully balanced to maintain focus on performance outcomes.

— The headquarters/field relationship is critical. Time will be gained or lost based on the QA staff's access to and communication with headquarters leadership of field operations. Territorial struggles can flare if relationships are strained.

— People don't necessarily resist change if they see some advantages for themselves and their work. Most managers and staff want to improve performance and welcome real assistance.

— Each individual office has a separate culture, with unique strengths, problems, relationships, needs, office climate and personality. Each improves on its own time schedule—no imposed timeframe can ensure change or progress. Just as organization-wide change requires 6 to 12 years, individual office change requires significant time.

— In field offices, the director's commitment is as crucial as the agency head's. Sometimes it is not possible to proceed with a quality program in an office whose director does not buy QA concepts, or whose personal style is unchangeably non-participative. It is best not to sink resources in such an office until leadership changes.

— The program should be dynamic and flexible, easily tailored to meet different circumstances and needs. Otherwise, offices will perceive it as one more "cookie cutter" approach to make them shape up to fit a headquarters design.

Next Steps

Plans are to continue strengthening QA in district offices, and in headquarters. Special effort will be directed toward measuring and meeting quality goals. Where quality has become predictable, greater effort will

be made to find system efficiencies so that timeliness becomes routine and investigators' caseloads are reasonable.

At the agency level, the continuing emphasis will be to:

— Improve forward planning and goal setting

— Refine the automated data system and ensure its use in everyday case tracking and management

— Continue to develop the capability and leadership of first line supervisors

— Develop a standardized agency-wide quality measurement system

— Improve case development

— Further emphasize investigative and attorney skills

— Add a comprehensive secretarial development program

— Tie the performance appraisal system even more closely to agency goals

— Continue to develop communication and mutual goals between field and headquarters and among management, union and employees.

EEOC has a long way to go on the road to excellence. From time to time since 1983, wrong turns, old problems and new mistakes slowed the pace of change. Still, the distance already covered is great and early indications are that Quality Assurance — EEOC's Total Quality Management—is the right vehicle for the rest of the journey.

Key Personnel and Individual Office Summaries

Key Personnel

For information, contact:

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Polly Mead, Director of the Office of Performance Services, has responsibility for implementing the Quality Assurance program in EEOC, and for staff development and training, Quality of Work Life, and performance planning and development programs.

Quality Assurance Staff

Branch Chiefs:
Gerald Patterson
Gene Pressior
Deidre Flippen (former)

Facilitators:
Kathryn Blair
Jacqueline Harney
Robert Jutte-Kraus
Jack McCririe
Gina Myers
JP Toothman

Trainers:
Kay Klugh
Gerald Nikolaus
Thomas O'Donnell
Laura Yobst

Secretaries:
Carolyn Farook
Angela Owens

Consultants:
Dr. Alan Brownsword
Dr. Bess Howard
Laurie Lippen
Elizabeth Rasmussen

Other Office of Performance Services staff who have made significant contributions to the Quality Assurance initiative include:

'ames Goldweber, Pat Ewing, Edward Alston, Roslyn Brown, Thelma Brown, Robert Hill, Cheryl Slay, Maxine Tolbert and Veronica Hogan, for the Case Management Study, Performance Analysis and Quality of Work Life Survey

Deborah Griglak, Linda Henson, and Sharon Jemeyson for Investigator Skills and Case Management Training

Betty L. Donahue for Quality of Work Life

Directors of Offices Featured in Case Study

We wish to recognize those headquarters and field directors and their offices which have produced outstanding results through the application of QA. They are:

James H. Troy, Program Director

Jacquelyn Shelton, Director, Field Management Programs-West

Patricia Bivins, Director, New Orleans District Office

Kathleen Blunt, Director, Chicago District Office

Harriet Ehrlich, Director, Houston District Office

R. Edison Elkins, Director, Charlotte District Office

Chris Roggerson, Director, San Francisco District Office

Dolores Rozzi, Director, Office of Review and Appeals

John Seal, Management Director

Andrew Fishel, Director, Financial and Resource Management Services

Gilbert Sandate, Director, Equal Employment Opportunity Staff

Individual Office Summaries

The following pages contain summaries of actions taken in EEOC district and headquarters offices.

Charlotte District Office

Chicago District Office

Houston District Office

New Orleans District Office

San Francisco District Office

Office of Review and Appeals

Financial and Resource Management Services

Equal Employment Opportunity Staff

Charlotte District Office

Raleigh, North Carolina Area Office
Greensboro, North Carolina Local Office
Greenville, South Carolina Local Office

Date QA Program Initiated: August 1986

Areas Selected by District Office for Improvement:

— Communication and trust throughout office
— Management team cohesiveness
— Case Tracking and Management System
— Quality of investigations and determinations
— Production and timeliness
— Staff involvement

Major actions taken:

— Established a "Management Quality Circle" and a QA Steering Committee. Held a series of team development interventions for entire group of managers and supervisors. Interventions included individual interviews and data feedback; problem diagnosis, goal setting and action planning; communications skills and trust building activities; training in QA concepts.

— Trained management team in five-day supervision, motivation and leadership program. Improved communication between legal and investigative staff. Extensive application of participative management which mirrors Director's personal style.

— District Office developed an excellent streamlined case tracking and reporting system and used it to improve case management. A monthly data summary is sent to all employees, recognizing individual and team achievements on significant performance indicators and reporting total office progress. Frequent, consistent use of data to identify performance issues.

— Created District Office performance profile as focus for identifying barriers which impede quality and efficiency. Subcommittees of the QA Steering Committee select various projects to reduce barriers.

— Involved employee Unity Committee in improving interpersonal and social climate through a variety of functions and activities.

— Defined quality requirements for several key products in the case processing system and began giving prompt feedback to investigators when and why rework was necessary. Encouraged frequent communication between investigators and attorneys on individual cases.

Results to Date:

— Management team pleased with great improvement in cooperative teamwork and shared problem-solving. Follow-up interviews after one year revealed a more positive attitude about work, the District Office, and perceptions of quality and productivity.

— Production at end of FY 1987 per investigator was 13.7 percent higher than the national average. The previous year, it was 1.6 percent higher than the national average.

— Caseload per staff member shows continued steady decline, relieving stressful burden and permitting more thorough investigation of each case.

— Average processing time per case declined from 303 days in FY 1986 to 251 days in FY 1987, and is still declining.

— Number of cases recommended for litigation increased from 11 cases in FY 1986 to 35 in FY 1987.

— Grievances declined from eight in FY 1986 to four in FY 1987; to zero at mid-year FY 1988.

Next Steps:

— Office space being increased and re-designed to improve work environment.

— Team development and problem solving training for first-line supervisors and unit staff.

— Charlotte District Office will spearhead efforts to improve automated case tracking reports Commission-wide, providing a planned program of training, technical assistance and on-site demonstrations to other Commission offices.

District Director: R. Edison Elkins
QA Coordinator: John Edmonds
QA Staff: JP Toothman

Chicago District Office

Date QA Program Initiated: January 1986

Areas Selected by District Office for Improvement:

— Management team cohesiveness
— Quality of investigations
— Quality of charges and service to the public at intake
— Reduction of inventory
— Management-union relationship
— Staff morale

Major Actions Taken:

— Held QA training sessions, followed by a series of management team meetings on individual management style, communication, conflict resolution, and team building.

— Applied quality measurement procedures to intake unit as initial improvement target. Determined quality requirements of the charge and affidavit, disseminated requirements, measured conformance, identified weaknesses. Designed and conducted extensive training program for investigators to correct weaknesses.

— Collected feedback from clients on service quality. Posted quality service data in client waiting room and used it to maintain high standards through staff discussion and problem solving.

— Management team trained in supervision, motivation, and leadership.

— Staff designed and conducted three month training program for new investigators. Increasingly strong officewide emphasis on training.

— Healed management-union breach. Now hold regular "Time-Out" sessions for staff to share ideas with management. Feedback to staff meetings on ideas accepted, changes made.

— In management retreat sessions, developed three year plan to reduce inventory, improve case management. Hold regular quarterly sessions to review progress toward goals.

— Established "Employee Relations Committee" in FY 1987 to help create a positive work environment in the Chicago District Office. Committee organized employee participation in recommending/accomplishing a number of environmental improvements: painting and decoration of all public spaces; bulletin board for each employee; microwave for office use; observances and celebrations.

— New non-cash awards established to recognize more employees at more frequent intervals for contributions to quality and efficiency.

Results to Date:

— Greatly improved management team communication, and continued dedication to joint problem solving. Office met all but one of its ambitious targets for FY 1987, the first year of its three year plan.

— Increased number of cases closed by 437 from FY 1986 to FY 1987, an 18 percent gain.

— Reduced inventory by 16 percent from FY 1986 to FY 1987.

— Increased average closures per investigator from 54.6 in FY 1986 to 77.2 in FY 1987.

— Client feedback at intake indicates satisfaction with services and understanding of the charge intake process.

— Reduced average waiting interval for charging parties from one hour to less than fifteen minutes.

Next Steps:

— Major effort to reduce inventory further, and permanently eliminate problem of older cases by the end of FY 1989, third year of three year plan.

— Team development and training for first line supervisors and staff.

— Further efficiencies and improvements in case processing systems.

District Director: Kathleen Blunt
QA Coordinator: Charles Burtner
QA Staff: Gina Myers

Houston District Office

Date QA Program Initiated: February 1985

Areas Selected by District Office for Improvement:

— Management team development
— Reduction of number of older cases in inventory
— Quality of charges taken
— Quality of investigations and determinations
— Service to clients
— Staff morale

Major Actions Taken:

— Established "Management Quality Circle" which included all managers and supervisors. Held team building and QA training sessions, as well as beginning an ongoing discussion series on effective management approaches based on current books, articles, videotapes and local speakers.

— Created ad hoc problem-solving team of senior investigators who, with input from the investigative staff, developed a plan of action to resolve a growing inventory of old cases efficiently. Plan adopted and implemented.

— Designed statistical quality measurement program for intake process, including quality requirements and data collection system. Trained staff and supervisors in quality requirements, basic interviewing skills and charge taking. Used system data to identify performance weaknesses followed by coaching, training and some procedural changes.

— Established system to elicit ongoing feedback from clients (charging parties) at intake regarding service delivery, periodically providing results to staff and supervisors for analysis and action. Emphasized to staff the importance of continued close contact and good communication with charging parties throughout investigation.

— Trained management team in five-day supervision, motivation and leadership program. Supervisors exert strong influence on performance through written and oral communications to staff, frequent team meetings and personal example. Improved understanding and collaboration between legal and investigative staffs.

— Created new employee award categories emphasizing service, quality and professionalism, in addition to long standing focus on efficiency. Developed extensive use of non-financial recognition including official programs and celebrations, ad hoc fun affairs, District Office T-shirts, coffee mugs, staff photographs, prompt written congratulatory memos, and friendly unit competitions.

— Established QWL committee which involved staff in environmental issues and assisted in planning new office space. Also, staff frequently involved within supervisory units to identify, suggest and implement improvements in charge processing.

Results to Date:

— Management team improved its already open climate, and became highly informed in quality and productivity concepts. As one of the early QA sites, Houston District Office influenced other Commission offices to participate due to its positive experiences.

— Inventory of older cases eliminated in eight weeks. Ad hoc team also solved problem on a permanent basis through new case tracking procedures to be used by both supervisors and investigators.

— Based on measurements from the quality data system, in one year the defective rate for the initial charge dropped from 39 percent to 24 percent, investigator notes from 70 percent to 35 percent, and charge analysis from 16 percent to 1 percent.

— Number of determinations of "reasonable cause" increased from 66 in FY 1986 to 133 in FY 1987, probably reflecting improved quality of investigations. The "open door" policy of the regional attorney also expedited the processing of cause cases.

— Reduced average processing time per case from 233 days in last quarter FY 1987 to 171 days first quarter FY 1988.

— Reduced ratio of initial inquiries from potential charging parties to actual charges taken by 17.8 percent, reflecting better screening and counseling during intake process. Decrease represents a one-year workload for five investigators.

— Client feedback indicates ongoing high level of satisfaction with services provided at intake.

— In FY 1986 and 1987, Houston received the annual award for productivity improvements from the Federal Executive Board in Houston and was the subject of a case study on quality and productivity improvement by the American Productivity Center in FY 1987.

— Houston was one of the three top overall performers in the Commission in FY 1987.

Next Steps:

— Office due to move to new quarters in June 1988.

— Major effort being made this year to reduce inventory further through team problem solving and individual employee commitments.

District Director: Harriet Ehrlich
QA Coordinators: Barbara Brown, Marco Salinas
QA Staff: Kathryn Blair, Gerald Patterson

Date QA Program Initiated: April 1985

Areas Selected by District Office for Improvement:

— Management team cohesiveness
— Efficiency of case review process and work flow systems
— Quality of charges taken
— Quality of investigations
— Skills of investigators and clerical staff

Major Actions Taken:

— Established "Management Quality Circle" of all managers and supervisors. Held a series of QA training and team building sessions, including conflict resolution, communication skills, and trust building activities.

— Adapted quality measurement procedures to the case processing system. Identified redundant reviews and forms, as well as quality problems. Standardized quality criteria and trained staff in requirements. Eliminated some paperwork, streamlined procedures and reduced number of reviews.

— Managers and supervisors developed very active technical skill training program for investigators. Trained clerical staff in basic writing skills.

— Trained management team in five-day supervision, motivation and leadership program. Improved communication between legal and compliance staff.

— Institutionalized ongoing management team review of quality and efficiency data to identify performance issues.

— Established QWL committee which played a key role in planning for move to new space.

— Office moved to new space in March 1988.

Results to Date:

— Teamwork among managers significantly improved. Office Director especially pleased with increase in shared responsibility for decision-making. As one of the earliest QA sites, New Orleans actively influenced other Commission offices to participate based on their positive experiences.

— Increased percentage of "reasonable cause" determinations from 1.7 percent in 1985 to 3 percent in FY 1987.

— Improved acceptance rate of cases recommended to Commissioners for litigation from 55 percent in FY 1985 to 100 percent in FY 1986 and FY 1987, due to improved quality of investigations and more effective communication between legal and compliance units.

— Reduced pending inventory by 28 percent from FY 1985 to FY 1987.

— Increased number of successful conciliations from 5 in FY 1986 to 20 in FY 1987, probably due to improved quality of investigations.

— Based on measurements from the quality measurement system, improved quality of initial charge by 11 percent, investigator notes by 7 percent and case log by 24 percent.

— New Orleans one of three top overall performers in Commission in FY 1987.

Next Steps

— Identify further system improvements to increase efficiency.

— Provide training to first line supervisors and their units on team development and problem solving skills.

District Director: Patricia F. Bivins
QA Coordinator: Richard Polk
Training Coordinator: Merlin Broussard
QA Staff: Gina Myers

San Francisco District Office

Oakland Local Office
San Jose Local Office
Fresno Local Office

Date QA Program Initiated: May 1985

Areas Selected by District Office for Improvement:

— Litigation program
— Case management
— Number of older cases in inventory
— Quality of investigations
— Staff morale

Major Actions Taken:

— Established "Litigation Development Task Force" of trial attorneys, investigators and enforcement managers to streamline litigation development.

— Improved communication between legal and enforcement staff.

— Established "Management Quality Circle" of all managers and supervisors. Held a series of QA training and team building sessions, followed by periodic team meetings for problem diagnosis, goal setting and action planning.

— Solicited summaries from all supervisors of case management "best practices" and invited input from investigators. Resulting consensus on methods was adopted by all offices District-wide to ensure uniformity. Increased use of automated systems and improved procedures for tracking age of cases much more closely.

— Trained management team in five-day supervision, motivation and leadership program. Emphasized employee participation. Set up a "Sunshine Committee" to encourage socialization and informal celebrations such as office parties and picnics.

— Training needs identified by an employee task force; investigators participated in planning and conducting technical training.

Results to Date:

— Management team perceives improved communication and interaction.

— Active litigation program now soundly established. Increased annual number of cases from 11 in 1984 to 30 in 1985 and maintained at that level in FY 1986 and 1987.

— Reduced number of older cases in inventory from 2 percent to 1 percent in the first year, and maintaining at that level.

— Improved quality of investigations as perceived by managers and reflected in large increase in proposed litigation.

— Increased average closures per investigator by 15 percent from FY 1985 to FY 1986, and by 32 percent from FY 1986 to FY 1987.

— Staff morale considered by managers to be much improved.

— San Francisco was one of 3 top overall performers in the Commission in FY 1987.

Next Steps:

— Target further efficiencies in the system to reduce inventory, decrease average processing time and improve caseload per investigator.

District Director: Chris Roggerson
QA Coordinators: Rockey Brown, Jon Peck
QA Staff: Jack McCririe, JP Toothman, Gerald Patterson

Office of Review and Appeals

Date QA Program Initiated: April 1985

Areas Selected by Office for Improvement:
— Case management
— Indexing of decisions
— Reduction of inventory
— Quality of decisions
— Enforcement of decisions
— Outreach program

Major actions taken:
— Began with three day management retreat which started with several team building exercises. Emphasis was on developing a more cooperative working relationship, stressing the furtherance of Office and Commission goals as opposed to unit or division goals.
— Reorganized Office creating three distinct divisions to deal exclusively with employee appeals, petitions of MSPB decisions and requests to reopen Commission decisions, and case control (intake and tracking), compliance and office administration. Reorganization improved instructions and technical guidance to staff; separate case assignment processes (review/appeals) maximized objectivity in decision development; case screening by legal, as opposed to administrative, staff facilitated quicker and more accurate processing of case files and development of decisions for simple appeals; centralization of all administrative functions vastly improved overall office efficiency and timeliness of case processing.
— Created a special case processing and a research and analysis unit. The research unit's case studies, statistical and legal analyses and interpretations of major court decisions provide important informational base which supports the planning of ORA case processing strategies and provides technical guidance to staff.
— Established internal automated data system. The data system provides case processing accountability, a complete record of case bases and issues, descriptions of case findings, a record of all compliance activities and benefits, a record of appellant civil actions and final records disposition; special timeframe cases (ADEA complaints and MSPB cases) are more easily identified and expeditiously processed.
— Developed and published an index of ORA decisions which enables ORA to fulfill Freedom of Information Act obligations while providing guidance to agencies on ORA positions on case issues.
— Established an in-office law library of all major legal publications and reference books.
— Implemented a formal compliance program.
— Established a national outreach program. Consulted with all major agency headquarters and field installation officials on administrative and technical problems in the processing of appeals, and the quality of decision development. Outreach activities significantly improved communications, trust and respect between ORA and other federal agency officials, special emphasis program personnel, union and other concerned officials. It provides ongoing opportunities for training agency EEO, personnel, labor and employee relations staff. The program has also provided EEOC an invaluable opportunity to be more involved with other dispute resolution agencies (i.e., MSPB, FLRA, OPM, etc.)
— Organized and staged in concert with the President's Council on Management Improvement, the first national dispute resolution conferences (three) in 1986 and 1987.
— Developed an "attorney deskbook" as a training outline for new staff. More training is individually tailored to the unit to which the attorney is assigned.

Results to Date:
— Friendly competition exists between branches and divisions within ORA. In some instances work assignments are handled by team, rather than individual efforts.
— Overall office inventory has been reduced from a one-time high of over 5,000 cases in the second quarter of FY 1987 to less than 2,400 cases at the end of the second quarter of FY 1988, which represents an inventory of less than six months.
— Number of closures over the last two years increased by 56 percent to a high in FY 1987 of 5,659 closures.
— Case processing time has been reduced from as much as t. o years to an average of less than one year.
— On an average, MSPB cases are completed in less than 90 days; procedural cases are completed in less than 120 days, and requests for reopening are completed in less than 180 days.
— The quality of ORA decisions has increased to the point where ORA is a recognized authority on Federal sector EEO law. Federal agencies nation-wide have requested consultations and seminars to be presented by ORA.
— Compliance monitoring has resulted in an average of almost $1 million dollars each year in benefits awarded to appellants, with almost $1.5 million obtained in the first half of FY 1988. This is an increase from the $800,000 in FY 1985.

Next Steps:
— Major effort to further reduce inventory so that all cases can be processed within 180 days.
— Continue upgrading all office systems and, in particular, the computer system.

Office Director: Dolores L. Rozzi
QA Coordinator: Richard Dickerson
QA Staff: Gerald Patterson

Financial and Resource Management Services
Disbursement Section

Date QA Program Initiated: January 1985

Areas Selected by Disbursement Section for Improvement:

— Staff concerns regarding impact of new computer

— High volume of travel vouchers and resulting processing delays

— Service to EEOC travellers

Major Actions Taken:

— Held staff meeting and team building session to air concerns about new computer. Answered questions about technical process and new office procedures.

— Applied quality measurement procedures to travel voucher processing. Identified quality requirements, measured quality results, identified quality issues. Using statistical data analysis, conducted brainstorming and problem solving sessions with managers and staff.

— Delegated primary voucher review to Administrative Officers in agency. Held conference call with Administrative Officers to discuss new system and answer questions.

— Implemented statistical random sampling of vouchers in Disbursement Section.

— Developed "EEOC Traveller's Handbook" to reduce traveller errors. Instituted "Voucher Defect Review Form" to prevent 10 most common voucher errors.

— Conducted internal customer survey on quality of service.

Results to Date:

— Transition to new computer more efficient and comfortable for staff.

— Reduced voucher processing time from 12-15 days in FY 1985 to 3-5 days in FY 1986 while maintaining quality. This new standard was maintained 75 percent of the time in FY 1987 with fewer staff.

— Customer satisfaction high; staff takes pride in meeting quality and efficiency standards.

Next Steps:

— Disbursement Section now applying QA techniques to the problem of incorrect invoices submitted by vendors. Identifying major suppliers, meeting with them to discuss invoice requirements and payment timeframes, including new poster explaining requirements along with each purchase order. Results not in yet.

— Preparing new customer satisfaction survey to elicit feedback on service by travel agency used by EEOC.

Director of FRMS: Andrew Fishel
Chief, Finance Branch: Willie King
QA Coordinator: Elaine Bradley
QA Staff: Kathryn Blair, Gerald Patterson

Equal Employment Opportunity Staff

In-House Agency EEO Program

Date QA Program Initiated: March 1985

Area Selected by EEO Staff for Improvement:

— Quality of informal EEO counseling and investigation of internal discrimination complaints
— Length of case processing time
— Stage of case resolution
— Efficiency of management systems

Major Actions Taken:

— Held QA training and a series of team building meetings with EEO staff, followed by periodic problem solving sessions.

— Centralized all informal EEO counseling to Washington EEO staff. Provided training to all staff in basic counseling and dispute resolution techniques.

— Applied quality measurement procedures and work flow analysis to the case processing system. Solicited feedback from system users. Identified problems in quality at the clerical, counseling, investigation and decision-writing levels.

— Developed standardized investigative plans, procedures, interrogatories, questionnaires and decision-writing formats. Defined case processing expectations and incorporated in annual performance agreements.

— Installed automated case tracking system.

— Provided advanced training for investigators in rules of evidence, dispute resolution techniques and changes in Federal sector discrimination complaint regulations.

Results to Date:

— Upper management perceives significant improvement in quality of written case processing products, marked by thoroughness and consistency of content and format.

— Ratio of formal complaints per counseling contacts declined from 78.4 percent in FY 1985 to 55.9 percent in FY 1987 probably due to improved counseling.

— Year-end case inventory reduced from 219 in 1985 to 161 in 1987, reduction of 26.5 percent, the lowest case inventory since 1979.

Next Steps:

— Improve overall average case processing time and annual number of case closures.

— Target further gains in year-end inventory reduction.

Director, EEO Staff: Gilbert Sandate
Chief, Complaints Processing Branch: Janice Fritts
QA Coordinator: Mavora Bynum
QA Staff: Kathryn Blair, Thelma Brown

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Total Quality Management: A DoD Example

CDR J. C. Boudreaux
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TOTAL QUALITY MANAGEMENT:
A DOD EXAMPLE

Commander J. C. Boudreaux, USN

Quality management principles are not new in the United States. Walter Shewhart wrote about control of industrial quality as early as 1931. Dr. W. Edwards Deming and Dr. J. M. Juran, two prominent American quality theorists, introduced quality management techniques to Japan in the 1950s. S. V. Feigenbaum, P. B. Crosby and others have translated general theories into practical applications that are changing the corporate outlook of United States industry toward quality management. Although each individual quality theorist has a slightly different emphasis, there are six basic principles to which all adhere.

First, management, not the worker, is responsible for process quality. Management must provide resources and policy decisions to make process changes and facilitate tasks of the work force.

Second, continuous improvement of process quality through control of variability yields productivity improvement. Quality management emphasizes continuous search for a better productivity by improving work methods and reducing rework.

Third, the worker can provide a significant input to process quality control. The operator of a process is in the best position to identify process weaknesses and to offer suggestions for process improvement.

Fourth, quality cannot be inspected into a product. Inspection identifies the defective product but cannot eliminate cause of the defect.

Fifth, statistical and graphic techniques support the quality management decision-making process. Simple graphs define process capability and can be used by the manager to make decisions concerning changes to the process.

Sixth, all levels of the organization must be trained to understand the company's quality philosophy and to implement that policy. Every level of an organization must have the common mission and common language with which to communicate.

Resurgence of these principles has been stimulated by American industry's reaction to the Japanese competition in international markets. United States industry has begun using these total quality management principles to regain the competitive position in the world market. At least one group of government agencies is following industry's lead.

A recent example of total quality management illustrates applicability of these quality principles to production and administrative areas within Department of Defense organizations. The Naval Aviation Depot (NADEP), North Island, San Diego, Calif., is a Department of Defense organization making a long-term commitment to total quality management.

The NADEP is a complex industrial facility performing depot-level maintenance, overhauling and repairing engines and components from Naval aircraft, and performing similar maintenance on support systems related to naval aviation. The Navy operates six NADEPs at Norfolk, Va., Cherry Point, N.C., Jacksonville, Fla., Pensacola, Fla., Alameda, Calif., and San Diego, Calif. The six NADEPs represent a complex mix of products and processes.

One early effort to improve quality control was an artisan certification program managed by the Quality Assurance Department at each NADEP. Previous programs included quality circles, quality goals, slogan programs, quality reporting and auditing activities. These programs contributed to quality awareness but fell short of providing coordinated, continuing improvement in the overall quality of product and in the efficiency of NADEP operations.

By instituting quality management techniques, NADEP at North Island focused on increasing productivity and providing a product to meet customer expectations. The NADEP emphasized long-term management commitment to change corporate attitude. Previously, management approached change with fear and uncertainty. After total quality management practices were implemented, management actively sought and encouraged change.

Using quality management, the organization was trained at all levels to think in terms of process quality. The work force was taught to use simple graphical methods of statistical process control to make statistically based decisions affecting their processes. The new attitude included mutual action among departments of the organization for process quality. Customer requirements were used to define good quality and the definition of customer was extended to include the user of products within and outside the organization. One management role in quality management was to assist each organization element to recognize internal and external customers and requirements.

The quality management program at NADEP in North Island evolved slowly during 4 years. Initial activity included exchanging books and discussing current industrial trends in quality management. Interest grew and, after visits to local industry, a small group of managers started an informal training program based on seminars of Dr. Deming. Between 1980-84 the awareness and training effort exposed 200 upper and middle managers to quality management ideas. A network developed to obtain and distribute literature concerning quality activity occurring in private industry. Dr. Deming provided personal support to the network in the form of appearances at North Island to discuss quality theory.

In 1984, the commanding officer of NADEP, North Island, commissioned a demonstration effort in the Manufacturing Division of the facility. The demonstration attempted to establish implementation procedures and apply quality management techniques to the working environment. Specific objective was to establish the customer-to-supplier relationship between the grinding and plating shops to reduce defects and reduce cost of correcting defects. By identifying and breaking down communication barriers between shops, the NADEP management started a continuous cycle of improvement in the processes supported by the two shops. The resulting cooperation between the shops was directed at building quality into the processes and eliminating the requirement for extensive inspection for defects. The initial training in group decision-making established common methods to examine the process. Communications were sustained at regular meetings between the shops.

In addition to working-level meetings, shop supervisors met weekly with the next level of supervision. This management team established priorities and assigned resources to working-level activities. This quality process was developed using guidelines from Kaoru Ishakawa's *Guide to Quality Control* but was uniquely adapted by the Naval Aviation Depot to its organization.

Any quality improvement system is a process and evolves by using techniques of quality management. The NADEP quality improvement system was systematically changed over a period of years. This dynamic management effort was successful in transforming the daily business routine from conflict to teamwork. In one specific case, combined efforts of the plating and grinding teams reduced the defect rate on a H-46 helicopter blade fold pin rework from 70 to 3 percent. Detailed techniques used to identify and eliminate contributors to the defect rate were part of the statistical process control methods of quality management.

While the NADEP demonstration effort continued in selected shops, upper management was taking plant-wide initiatives, using lessons learned from the demonstration. From the demonstration effort, management realized that principles of process quality management applied to service and support processes as well as to production line processes. Concepts were successfully applied to such diverse areas as long-range planning activities and administration of individual travel procedures.

The customer-supplier emphasis for service-oriented efforts were similar to the production effort. Each management group asked initial questions: What is our product? Who is our customer? Who are our suppliers?

With answers to these questions the management used basic process quality management techniques to measure performance of the process that they managed. Management identified elements of the process they used to transform suppliers' inputs into the output for their customers. Each group identified and prioritized opportunities to improve their process and to enhance the quality of their ultimate product.

Success of the improvement initially depended on energetic communication. Communicating with suppliers ensured input specifications were met; communicating with process operators ensured the quality definitions support the ultimate product; and communicating with the customer ensured

the product would meet the customer's expectations. Functions of "continuous process audit" and "control point sampling" were carried out continuously by management. Process audit activity was initiated by management using information from the customer or from workers that indicated an opportunity to improve the system. Control point sampling allowed management to monitor process fluctuations using measuremen s established and collected by the process operators at the working level.

Once the process control system was in place, management continuously asked questions: How can we reduce variability in our product quality by reducing variability in our control points? Have conditions of our supplier's inputs changed? Have customers' requirements changed? Translating the answers to these ques-

tions into action brought about systematic changes to improve process quality.

Principles demonstrated at North Island are applicable everywhere in the Department of Defense. By using this process control system, management can more closely control quality of output and avoid the quick-reaction crisis that leads to inefficiency. Advantages gained through quality control ultimately result in increased productivity and reduced cost through elimination of process inefficiencies. The process control system applies regardless of the nature of the product. The concepts apply to all systems in the Department of Defense whether the product is hardware, software, paperwork or services. Ideas of customer-to-supplier interaction have tremendous potential for the Department of Defense.

Just as United States industry is being driven by competitive pressure to reexamine management techniques, the Department of Defense is being driven by budget reduction to improve productivity and increase cost effectiveness. The Department of Defense has taken specific actions to address specific productivity and cost-effectiveness symptoms.

Total quality management represents a proved method that can be applied in all Department of Defense organizations to increase productivity and to reduce cost. Budget pressures demand action. Inaction will ultimately degrade the effectiveness of our defense system.

Commander Boudreaux is assigned to the Naval Air Systems Command, Washington, D.C.

INSIDE DSMC

Ortengren *Keightly* *Fournier* *Ainsley* *McGeary* *Reig*

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